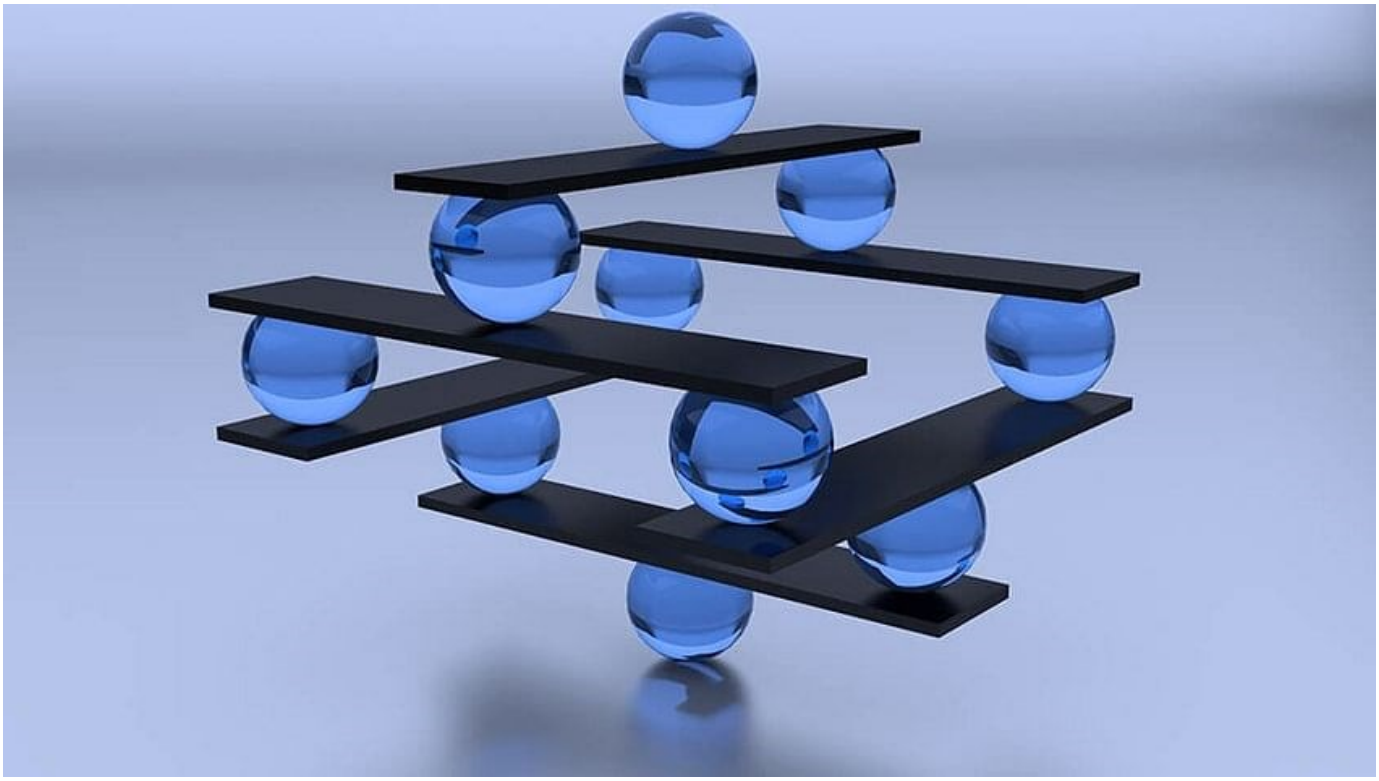
On the Eve of our Founder-Chancellor's Birthday 2024

"SLOWNESS TO CHANGE USUALLY MEANS FEAR OF THE NEW".

Philip B Crosby

Pioneer in Quality Management

"It is always cheaper to do the job right the first time."



Faculty of Management Studies

Dr. M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
DEEMED TO BE UNIVERSITY
University with Graded Autonomy Status
(An ISO 21001 : 2018 Certified Institution)
Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India.

Philip B Crosby

Pioneer in Quality Management

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Dedication

Kaoru Ishikawa

13 Jul 1915 <<::>> 16 Apl 1989

FOREWORD

"The problem of quality management is not what people don't know about it. The problem is what they think they do know."

In the realm of quality management, certain figures stand out for their profound contributions that have shaped industries worldwide. Among these luminaries, Philip B. Crosby occupies a prominent place. His insights, methodologies, and philosophies have not only revolutionized how businesses approach quality but have also become timeless principles guiding organizational excellence.

Distilled by Crosby, 'Four Absolutes of Quality Management' are as follows:

1. *Quality is defined as conformance to requirements.*
2. *The system for achieving quality is prevention, not appraisal.*
3. *The performance standard is zero defects.*
4. *The measurement of quality is the price of non-conformance.*

In 1965 Crosby was promoted to the position of the Corporate Vice President and Director of Quality at the ITT Corporation for 14 years. Due to the magnitude of response to his book "*Quality is Free*," he left the ITT Corporation and started his own consultancy company, Philip Crosby Associates, and started explaining quality principles & practices to organizations.

He launched Career IV Inc, a consultancy firm advising on the development of senior executives after his retirement from Philip Crosby Associates. On the quality crisis, Crosby devised the principle of *"doing it right the first time"* (DIRFT). He also included four major principles:

1. *The definition of quality is conformance to product and customer's requirements.*
2. *Prevention is the system of quality.*
3. *Zero Defects should be the performance standard.*

4. *Quality measurement is the price of non-conformance*

He believed that establishment of good quality management principles in organizations will have more savings returns than what the organization pays for the cost of the quality system. Crosby stated that since "quality is free" it is less expensive to do it right the first time rather than paying for repairs and reworks.

This book –'PHILIP B CROBY -Pioneer in Quality Management' – containing 16 chapters running into 202 pages systematically provides a brief account about his life, his expertise in the fields of quality and his achievements. Chapter-1 contains the complete his interview to **IndustryWeek** with the relevant web link. His concepts of 'Zero Defects' and 'Quality is free' have been explained in great detail with the relevant web links. Ten of his books (Chapter-8) have been briefly discussed and also, a complete list of his books and the required web links to reach/learn have been provided.

Chapter-11 provides SIX articles, by leading quality authorities, on the life and his works covering the variety and depth of his excellent skills in quality. The special feature of the book is: Containing several illustrative/informative cartoons on 'Zero Defects', 'SIX Sigma', '14 Points' and 'Quality is Free'.

The overall contents of the book, it is hoped, would offer several detailed information on his life, contributions and other achievements in the field of quality. The job of the Department of Management Studies in bringing this book is highly appreciated.

Prof Dr M Ravichandran
Pro Vice-Chancellor
Dr MGR Educational and Research Institute

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Quality is defined as conformance to requirements, with requirements encompassing both product specifications and customer expectations. Quality system: The quality management system should be based on defect prevention, rather than relying on inspection or correction after the fact. Performance standard: The goal in terms of quality should be to achieve zero defects, ensuring that all products meet specified requirements. Measurement of quality: Quality is measured by the cost of nonconformance, i.e., the costs associated with failing to meet requirements. Crosby argued that implementing strong quality management principles would enable organizations to achieve significant savings that far exceed the costs of establishing a robust quality system. According to Crosby, "quality is free" because it is more cost-effective to do things right the first time than to incur additional expenses from rework and repairs.

From 1957 to 1965 he served for the Martin Corporation, where he worked as quality control manager in the Pershing missile project. From then on, he began to have positions related to quality control in various companies in North America. For instance, from 1965 to 1979 he was director of quality and vice president at the ITT company. In 1979, based on all the experience he had acquired over the years, he decided to found Philip Crosby Associates (PCA) based in Winter Park, Florida. After ten years it became an organization with 300 employees around the world and with $80 million dollars in profits.

The key to PCA success was the management, which was influenced by Crosby, and established a preventive culture in order to avoid complicated situations and produce negative, and perhaps irreversible, effects on the company. PCA generated many admirers and, in short time, several companies like GM, Chrysler, Motorola, Xerox, and hundreds of corporations around the world came to PCA and Crosby to learn about Quality Management and implement it.

Philip Crosby's ideas on quality came from his vast experience of working with an assembly line. His main focus was on zero defects which ultimately led to the adoption of this concept by the modern Six Sigma Quality movement. Mr Crosby explained the idea that zero defects is not a phenomenon that originated on the assembly line. He defined quality as a conformity to a set of specifications defined by the management rather than a vague concept of "goodness." However, these specifications are set according to the needs and wants of the customer rather than being arbitrarily defined.

Crosby was a great driver of business and its development in North America. His life ended on August 18, 2001, while he was with his family in Asheville, North Carolina, United States. Crosby died due to a respiratory failure.

This book –"PHILIP B CROSBY – Pioneer in Quality Management", published by the Faculty of Management Studies - containing 16 chapters running into more then 200 pages, provides, in a serious/sincere attempt, the Crosby's life, achievements, contributions in the field of quality management.

The most attractive/interesting feature here is this: Highly studied and selected Cartoons on 'ZERO Effects', 'SIX Sigma', '14 Points' & 'Quality is FREE'. These cartoons take the eyes of the readers to the various intricated aspects of 'Quality Management'.

Some SIX interesting articles, by the quality specialists published in the famous international Journals, on the life and work of Philip B Crosby are placed in the Chapter-11 and these provide the variety and depth of excellent skills in quality.

The Faculty of Management Studies strongly believes that the contents of this book would invite the attention of all who are interested in the process of 'Quality Management'.

Prof Dr G Brindha
Prof Dr S Ramalingam

An Interview

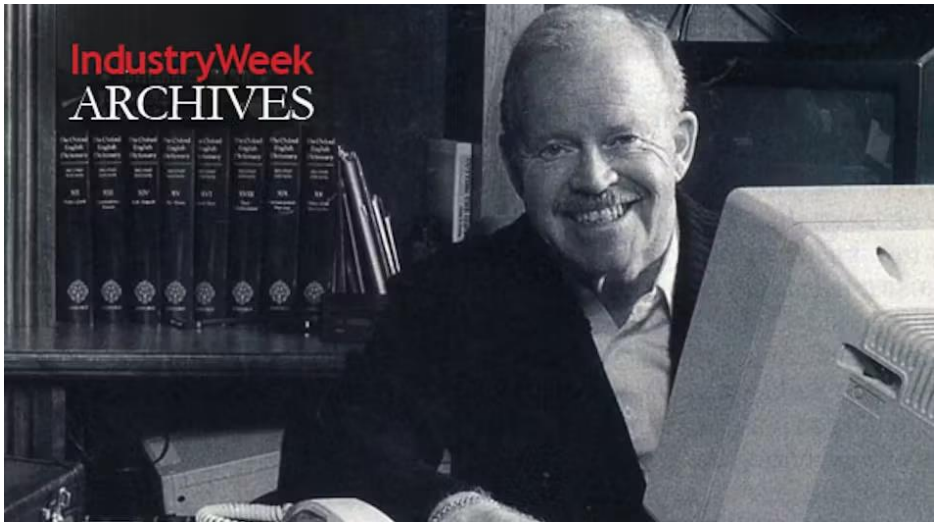
with

Philip B Crosby

The Guru of Quality Management

https://www.industryweek.com/operations/quality/article/21964139/philip-crosby-quality-is-still-free

{Interviewed by IndustryWeek}



In this interview, Philip Crosby offers his thoughts on quality management as we move into the next century.
Tim Stevens

IW: *You are well-known for the expression, "Quality is free," which is also the title of your first book on quality. Please briefly explain what you mean by that statement.*

CROSBY: It goes back *to* how people think about quality. Conventionally, quality is always looked at as goodness, as gold-plating. Quality is viewed as an expense, a trade-off, something that you have to spend money on. But you can't manage with goodness as your definition of quality. Quality is conformance to carefully thought-out requirements. So quality is free because it is already built-in. The expense of quality is nonconformance. The title of my book, *Quality Is Free,* actually comes from my old boss at ITT, Harold Geneen. He and I were having a discussion on quality one day, and we were talking about the difficulties in getting some of the units to get things done right the

first time. He said, "I don't understand why they fight quality. It's free." That's a good line.

The customer is the one you have to make successful. You have to understand what they need and learn how to give it to them.

IW: *You are quoted as saying, "It's not what people* don't know *about quality that gets them in trouble, it's what they* think they know *that's the problem."*

CROSBY: People say things like "the workers are the problem with quality." That's not true. Workers pretty much do what management tells them to do. People think that quality is some undefinable thing that you only know when you see it. Yet quality requirements are clear. They talk about vague things like delighting the customer, but you can't tell people what that really means, so you can't manage that way. They think that error is inevitable, that as long as humans are involved you'll have mistakes. These things are only true when management makes it happen that way.

IW: *What are some guidelines you can give for establishing a quality-improvement effort?*

CROSBY: If you're going to be a quality leader, you have to be able to explain to people what you want, have an agenda, and have measurements. So we're back to the four absolutes of quality that were the cornerstones of the quality college. First, quality is conformance to requirements, not goodness. That means that we are going to make it very clear what we are going to give the customer, internal or external. We're going to all row in the same direction. As we get smarter, we are going to improve the requirements.

Quality starts to go to hell when you delegate it. So when I say commitment, I mean CEOs in there working and doing things, not just saying, 'Yes, I bless this thing, and here's some money to do it.'

The second absolute, and the basic aim of quality management, is prevention. Quality control is aimed at detection, finding problems as early as possible, and getting them fixed -- and that's a noble thing. But what we want to do is vaccinate the company with the quality philosophy of prevention. So instead of setting up the world's largest smallpox hospital, we vaccinate people and then we don't need a smallpox hospital. That's the same way you have to run a company, by preventing the problems. There really isn't any system you can put in place that causes things to happen; it's a question of understanding the basic concepts.

Then you have to have performance requirements. In manufacturing, that performance standard is often acceptable quality levels -- 1 %, 2% defective. That's the way things are planned. That's what quality control is all about. But

we don't want that. We want to do things right, and so the symbolic way of saying doing things right the first time is zero defects. That's the third absolute, that zero defects is the performance standard, not some acceptable level of defects like six sigma. It means doing exactly what you said you were going to do -- that's really the definition of quality. That way you save the expenses of doing things over again, and you don't disappoint anybody.

Cut Your Costs of Nonconformance

IW: *What kind of gain can a company realize from a well-run zero-defects-based quality program?*

CROSBY: Something like 20% to 25% of revenues. You should be able to cut your cost of nonconformance in half in about a year to a year and a half. Then you should be able to get it down to where it's just a trace -- what you spend is primarily on education and evaluation.

IW: *What is the role of the customer in determining quality?*

CROSBY: The customer is the one you have to make successful. You have to understand what they need and learn how to give it to them. It's not a matter of just sitting down and having a focus group or something like that. It's a full-time job figuring out what your customer wants. How can I be useful to this customer?

The place where I bought my car has a car wash on Saturday morning. So every Saturday I go in, have a cup of coffee, and read my paper while they wash my car. Now I didn't ask them about that. If they'd interviewed me for 20 hours I probably wouldn't have said, "I'd like you to wash my car every Saturday morning." It never would have occurred to me.

So now the quality-control people ask, "Where do we get these requirements?" And I say, "That's what business is about; that's what life is all about." Business is transactions and relationships. And there is no system you set up where a customer is going to tell you what they want.

IW: *You suggest that getting management support, management commitment, is a key point in developing a zero-defects philosophy in a company. With all the emphasis on quality today, is this still a problem?*

CROSBY: Oh, but that is *the* problem. Quality starts to go to hell when you delegate it. So when I say commitment, I mean CEOs in there working and doing things, not just saying, "Yes, I bless this thing, and here's some money to do it." It doesn't work that way. It's like parenting. You can't delegate the cuddle and the evening prayer; you have to do that yourself.

W: *What are some basic mistakes made by executive management in pursuing a quality-improvement initiative?*

CROSBY: All you need is for the CEO to say, "Quality is the most important thing we have around here, but don't forget we still have to make a buck. Don't get carried away with this thing." Say that, and it's all gone. Another mistake is that most of the time the CEO is back up in the office going over accounting figures or inventory, or beating up on suppliers, and not paying attention to the customers. So I advise them, "Nail your office door shut and go down and stand in the front of the store if you want to run the place."

*Please visit the cited Web Page to know MORE about "***Industry Week***"*

Also, kindly make use of the following Web Pages:

01] https://asq.org/quality-progress/articles/philip-b-crosbys-mark-on-quality?id=dc73c10ba175431ebe4f87a93f37e5c6

02] https://www.youtube.com/watch?v=RznQBpqi4dg **[Video]**
''The Quality Man'' Philip Crosby Explains Absolutes of Quality Management

HI, I'M ALAN, FROM THE QUALITY ASSURANCE DEPART-MENT.
DON'T BE WORRIED ABOUT QUALITY. I ASSURE YOU WE HAVE PLENTY OF IT.
THAT'S ALL YOU DO?
HEY, I DON'T TELL YOU HOW TO DO YOUR JOB.
Dilbert.com
@ScottAdams6eyes
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"They say that I'm a customer and that they're working to make everybody's job a lot better....
DEPARTMENTAL MISSION STATEMENT
M137
"I say they're not working hard enough."

Contributions

of

Crosby

18 Jun 1926 <::> 18 Aug 2001

https://opexlearning.com/resources/philip-crosby-contributions-to-the-theory-of-process-improvement-and-six-sigma/27873/

Philip Crosby is a noted quality professional, author, and consultant who is widely known for promoting the concept of "zero defects" and for attempting to define quality from the viewpoint of conformance to requirements.

He was born in West Virginia in 1926. He graduated from Western Reserve University and rendered service in the Navy during World War II and then again in the Korean War. He graduated from the Ohio College of Podiatric Medicine. His working life started on the assembly line in 1952 at the Crosley Corporation, later switching on to the Bendix Corporation in 1955. After two years, he joined as a senior quality engineer at The Martin Company in Florida where he developed and implemented the zero defects concept.

In 1965 Crosby was promoted to the position of the Corporate Vice President and Director of Quality at the ITT Corporation for 14 years. Due to the magnitude of response to his book "*Quality is Free*," he left the ITT Corporation and started his own consultancy company, Philip Crosby Associates, and as defined in his book, started explaining quality principles & practices to organizations.

His company was floated in 1985 for $30 million. In 1991, he launched Career IV Inc, a consultancy firm advising on the development of senior executives after his retirement from Philip Crosby Associates. On the quality crisis, Crosby devised the principle of *"doing it right the first time"* (DIRFT). He also included four major principles:

1. *The definition of quality is conformance to product and customer's requirements.*
2. *Prevention is the system of quality.*
3. *Zero Defects should be the performance standard.*
4. *Quality measurement is the price of non-conformance*

He believed that establishment of good quality management principles in organizations will have more savings returns than what the organization pays for the cost of the quality system. Crosby stated that since "quality is free" it is less expensive to do it right the first time rather than paying for repairs and reworks.

Contributions to Six Sigma & Process Improvement

The Zero-Defect Theory:
The Zero Defects theory states that there is no existence of waste in a project. Waste refers to anything that is unproductive i.e. processes, tools, and employees etc.

Anything that is not adding any value to a project should be eliminated, thereby leading to the elimination of waste. Eliminating waste leads to process improvement and consequently lowers costs. The zero defects theory is the concept of doing it right the first time☐ to avoid cost and time spent later in the process of project management.

14 Steps to Quality Improvement:

Crosby gave 14 steps for process improvement. They are as follows:

1. Management's commitment towards quality should be clear to all in the organization and those outside it.
2. Creation of quality improvement teams with senior representatives from all departments.
3. Continuous measurement of processes to determine current and potential issues related to quality.
4. The cost of poor quality has to be calculated.

5. Quality awareness has to be raised in the organization.
6. Corrective actions should be taken to address quality issues.
7. Establishment of a Zero Defect committee to monitor the progress of quality improvement.
8. Quality improvement training to all the employees.
9. Organize zero defects days in the organization.
10. All employees should be encouraged to set their own quality improvement goals.
11. Obstacles to quality should be discussed with employees in an open communication.
12. Participants' efforts should be recognized.
13. Quality councils should be created.
14. Quality improvement is a continuous process. It keeps going.

Conclusions:

Philip Crosby's ideas on quality came from his vast experience of working with an assembly line. His main focus was on zero defects which ultimately led to the adoption of this concept by the modern Six Sigma Quality movement.

Mr. Crosby explained the idea that zero defects is not a phenomenon that originated on the assembly line. He defined quality as a conformity to a set of specifications defined by the management rather than a vague concept of "goodness." However, these specifications are set according to the needs and wants of the customer rather than being arbitrarily defined.

Examples of Philip B. Crosby achievements

- Philip B. Crosby is best known for his work in the field of quality management. His most famous contribution is his development of the concept of zero defects. This concept, introduced in his 1979 book Quality Is Free, emphasized that quality must be built into products and services from the ground up, rather than being treated as an afterthought. Crosby's zero defects concept revolutionized the way companies approach quality control and is credited with helping to bring down defects from the range of 20-40% to less than 1%.
- Crosby was also an innovator in the field of quality assurance. He developed a fourteen-step process for quality assurance, which has become an industry standard and is used in many organizations today. This process encourages companies to adopt a total quality management approach, which emphasizes employee involvement and continuous improvement.

- Crosby was a strong proponent of the "prevention is better than cure" approach to quality management. He believed that the best way to ensure quality was to prevent defects from occurring in the first place. This philosophy is now a cornerstone of many quality management systems, and it has led to a greater emphasis on prevention rather than inspection.
- Lastly, Crosby is also credited with helping to popularize the concept of Total Quality Management. His 1982 book Quality Without Tears outlined a framework for managing quality across the organization and emphasized the importance of employee involvement in achieving quality goals. This approach has since become a cornerstone of many organizations' quality management systems, and it has helped to ensure that quality is a priority throughout the organization.

Advantages of Philip B. Crosby approach

Philip B. Crosby is renowned for his contributions to the field of quality management and for introducing the concept of zero defects. Below are some of the main advantages of his approach:

- Crosby's focus on prevention rather than detection of defects allowed companies to reduce costs significantly, as it was much less expensive to prevent defects from occurring than to identify and fix them after the product was already made.
- His emphasis on the concept of zero defects helped to ensure that any defects that did occur were addressed quickly and efficiently, thus improving the overall quality of the product.
- Crosby's concept of quality was based on the idea of "doing it right the first time", meaning that the product was to be designed and produced with the utmost attention to detail and precision. This would reduce the number of rework and scrap, resulting in a more cost-effective product.
- Crosby also believed that quality was a shared responsibility, meaning that everyone involved in the production process, from management to line workers, had to be committed to producing a quality product. This helped to ensure that all stakeholders had a vested interest in the product's success.

Limitations of Philip B. Crosby approach

Philip B. Crosby is an influential quality management expert and pioneer in the Total Quality Management movement. However, there are some limitations to his approach including:

- Limited vision - Crosby's view of quality management was limited in scope, focusing only on the manufacturing processes and not other areas such as customer service or product development.
- Lack of flexibility - Crosby's approach was also rigid and prescriptive, making it difficult to adapt to different contexts or changing conditions.
- Over-emphasis on cost savings - Although cost savings are important, Crosby's focus on it was too narrow and overlooked other benefits of quality management such as customer satisfaction.
- Lack of customer focus - Crosby's approach did not prioritize customer needs and feedback, which is an important factor in quality management.

Other approaches related to Philip B. Crosby

Philip B. Crosby is well known for his pioneering work in the field of quality control and quality management. His approach is highly regarded and often studied. However, there are other approaches that are related to Philip B. Crosby's work, such as:

- The Zero Defects (ZD) approach, which was developed by Philip B. Crosby in the 1970s. This approach focuses on the prevention of defects and the elimination of any rework. It encourages employees to take responsibility for their actions and to strive for perfection in their work.
- The Total Quality Management (TQM) approach, which was popularized by W. Edwards Deming in the 1950s. This approach focuses on continuous improvement and the use of customer feedback to drive change. It encourages everyone in the organization to be involved in the process of quality improvement.
- The Six Sigma approach, which was developed by Motorola in the 1980s. This approach focuses on reducing defects and improving customer satisfaction. It uses data-driven decision making and problem-solving techniques to maximize efficiency and reduce waste.

In summary, there are several approaches related to Philip B. Crosby's work, such as the Zero Defects approach, the Total Quality Management approach, and the Six Sigma approach. Each of these approaches has its own distinct advantages and can be applied to different situations to improve quality.

Please visit the following Web Pages

https://davidcrosby.com/

https://ceopedia.org/index.php/Philip_B._Crosby

Tributes

to

Philip B Crosby

June 18th would have been Philip B. Crosby's birthday. He lived through 2001 and is internationally recognized for his ideas on quality management practices.
Crosby was an engineer at heart. As a quality engineer developing the Pershing Missile, he conceptualized the idea of Zero Defects.

Quality is Free likely sits on the bookshelves of many across the world. Although it was originally published in 1979, it remains relevant and inspiring in today's global marketplace as well.

Crosby's response to the quality crisis was the principle of *"doing it right the first time"* (DIRFT). He also included four major principles:

1. *The definition of quality is conformance to requirements (requirements meaning both the product and the customer's requirements).*
2. *The system of quality is prevention.*
3. *The performance standard is zero defects (relative to requirements).*
4. *The measurement of quality is the price of nonconformance.*

His belief was that an organization that established a quality program will see savings returns that more than pay off the cost of the quality program: "*quality is free*".

https://proqc.com/blog/remembering-philip-b-crosby-quality-is-free/

A TRIBUTE TO PHILIP CROSBY

International Journal of Commerce and Management
ISSN: 1056-9219
Article publication date: 1 January 2002

Abstract

Philip Crosby, the renowned Quality Guru, passed away last August at the age of 75. His presence will be greatly missed. It is certain that individuals and businesses, for generations to come, will benefit from his profound thinking and writings. Crosby wrote more than a dozen books and numerous articles on quality management. There have also been several books and articles written *about* him. Philip Crosby was not only a visionary thinker, but also was a plain-speaking pragmatist. In his speeches, he effectively combined humor with a profound message. Crosby is well known for his zero defects and his 14 points that are taught in business courses all over the world. Several of Crosby's teachings pertaining to quality management are applicable not only to the individuals' professional lives, but also to their personal lives. As my tribute to this simple person with profound thoughts, I would like to point out a few of the teachings that have helped me over the years.

Citation

(2002), "A TRIBUTE TO PHILIP CROSBY", *International Journal of Commerce and Management*, Vol. 12 No. 1, pp. i-ii. https://doi.org/10.1108/eb047433

https://www.emerald.com/insight/content/doi/10.1108/eb047433/full/html?skipTracking=true

The Michi of a Quality Champion: A Tribute to Phil Crosby

****

Rick Harrington, Jr.
Chairman & CEO at Harrington Group Intl
(A Revolutionary Software Company)
Orlando, Florida, United States

Prologue

About a year after the NBC documentary aired for the first time, Marshall McDonald, the FPL Chairman at the time, and I had the opportunity to visit with Phil and give a brief lecture at his recently formed Quality College in Winter Park, Florida. After the visit, we stopped at the NASA complex near Vero Beach, and tag-teamed with Marshall, who was visiting to meet with members of the NASA leadership team and brief them on the new FPL quality system called QIP. During the course of our visit, Phil and Marshall gave the NASA leaders and program managers a version of the 'burnt toast' speech, which turned out to be a prophecy in the making.

They told NASA that flight delays were like burnt toast that was being swept under the rug, that NASA was burning the toast and scraping it clean, instead of fixing the toaster. Crosby predicted that the same quality control problems plaguing corporate America were slowly eroding the space agency's reputation, which at one time had been known as the number one organization in the world for quality and excellence. And he warned that, if they didn't do something to fix those problems and return to the days of zero defects, by the end of the 1980s these problems would bring the space agency to its knees. He reemphasized his time-honored trilogy of policy, education, and example and stated: "**You cannot be successful unless you understand what quality is and where it comes from. You must strive for and deliver defect-free space missions on time, all the time."** (Policy). "**Begin to understand the definition of quality is conformance to requirements, not goodness. The system of quality is prevention, not detection. The performance standard is Zero Defects, not acceptable quality levels. The measurement of quality is the price of non-conformance, not indexes."** (Education), **"Management has to walk the talk and serve as a personal example of what you want people to do. All the organizations who have had successful quality journeys were led by persons who set this example. They insisted on quality and would not compromise. You are missing the most important point about quality management. It is not about teams, about statistics, and it is not about motivation or awards. It is about management understanding the concepts of quality, and making it a part of the way to run the organization. And most importantly, it is about encouraging the upward flow of bad news, in order to get the problems out in the open and to deal with them and solve them once and for all."** (Example).

Five years later, the Challenger went up in a ball of smoke, and we remembered Phil Crosby's warning to NASA and his exhortation to stop burning the toast and scraping it clean, and to fix the toaster before it was too late. And we were sad--sad for NASA and the Challenger disaster, with

the seven lost lives and the crippling of the space agency for many years to come; and sad for the fall from grace of NASA, one of the quality greats. But we are not sad for Phil Crosby, for he has gone to a better place where, as his wife Peggy shared with us recently, he has finally achieved a state of zero-defects, a state of eternal happiness consistent with his beliefs in his God, and a place where he is forever learning.

The innovative concept of genius, regardless of time or place, often evokes negative reactions. Innovators are flies in the ointment of the dominant culture. They are members of the monkey wrench gang who disturb the drowsy status quo. They reject the comfort of consensus as they point and cry out at the emperor's nakedness. Phil possessed a form of intelligence that moved beyond normal ways of formal thinking, and in doing so he often disturbed the drowsy status quo. Thank you, Phil, for showing us your **Michi**, and for showing us a better way; for you were right after all: Quality is indeed free, or at least affordable, to those fortunate enough to have listened to you—our champion, our mentor, our coach, and our guide on the quality journey of life.

Sources: Many of the details concerning the material contained in this article came from personal interviews with Phil Crosby, along with videotapes and audiotapes, which were augmented by the personal notes of the author who spent many days, weeks and hours with Phil. The background material was provided by Phil Crosby's associates, clients and friends, and we are indebted to them for their assistance.

https://www.linkedin.com/pulse/michi-quality-champion-tribute-phil-crosby-rick-harrington-jr-

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Philip B Crosby

Philip B Crosby	
Born	Philip Bayard Crosby June 18, 1926 Wheeling, West Virginia, US
Died	August 18, 2001 (aged 75) Asheville, North Carolina, US[1]
Resting place	Palm Cemetery, Winter Park, Florida
Education	1950
Alma mater	Ohio College of Podiatric Medicine[2]
Occupation	Quality consultant
Years active	1952 – 1999
Employer(s)	The Martin Company, ITT Corporation, Philip Crosby Associates
Known for	Philosophies of Quality management, Zero

	Defects, Quality Management Maturity Grid
Notable work	*Quality Is Free* (1979)[3]
Spouse	Peggy
Children	2

*Philip Crosby (**Philip Bayard Crosby**; June 18, 1926 – August 18, 2001) was a businessman and author and is recognized as an influential quality guru. He is best known for the quality management concepts Quality is Free, **Zero Defects**, and the Four Absolutes of Quality. He additionally wrote several books such as 'Quality is Free: The Art of Making Quality Certain' and 'Quality Without Tears: The Art of Hassle-Free Management.'*

Philip Bayard "Phil" Crosby (June 18, 1926 – August 18, 2001) was a businessman and author who contributed to management theory and quality management practices. His birthplace was in Wheeling, West Virginia, United States. His father induced him to study pediatrics, although he never graduated. To make some money, Crosby starts working in a manufacturing plant. As he was gaining experience, he learned how to create methods to prevent problems in the factory. In 1952, he obtained a position as a technician at the Crosley Corporation in Richmond, Indiana.

From 1957 to 1965 he served for the Martin Corporation, where he worked as quality control manager in the Pershing missile project. From then on, he began to have positions related to quality control in various companies in North America. For instance, from 1965 to 1979 he was director of quality and vice president at the ITT company. In 1979, based on all the experience he had acquired over the years, he decided to found Philip Crosby Associates (PCA) based in Winter Park, Florida. After ten years it became an organization with 300 employees around the world and with $80 million dollars in profits.

The key to PCA success was the management, which was influenced by Crosby, and established a preventive culture in order to avoid complicated situations and produce negative, and perhaps irreversible, effects on the company. PCA generated many admirers and, in short time, several companies like GM, Chrysler, Motorola, Xerox, and hundreds of corporations around the world came to PCA and Crosby to learn about Quality Management and implement it.

Crosby balanced quality management with prevention. Crosby's vision did not embrace the inspection, experimentation, supervision and other non-preventive techniques. With the implementation of prevention, he tried to justify and verify his idea of "zero defects". Crosby argued that if prevention is properly executed there are no grounds to commit errors or defects in any product or service.

"Zero defects" is not a slogan, It constitutes a performance standard. Scholars estimate that in the sixties, several Japanese companies applied the principle of "zero defects", as a technical tool, but the responsibility of the implementation fell on the company's management. Unlike the United States where the responsibility fell on the worker.

In 1991, Crosby sells PCA in order to dedicate himself to the creation of Career IV, Inc. A company dedicated to dictate conferences and seminars to future executives. The vision of Career IV was to provide key knowledge about quality control and everything related to it and to future executives, which would bring great effects on companies in North America.

In 1997, Crosby would purchase the assets of PCA, which would give him the possibility to establish Philip Crosby Associates II, Inc. Philip Crosby Associates II was a center where he would teach in the field of quality. This reached 20 countries around the world and would gather clients from multinationals or small manufacturing and service companies.

Although he was a man dedicated to his companies, Philip Crosby spent a lot of time with his family. They lived in Winter Park, Florida, with his wife Peggy. In the summertime, they would spend time at their other property located in Highlands, North Carolina.

In the beginning of 1998, he published his autobiography "Quality and Me". The next year, he would publish "The Reliable Organization".

In his texts or interventions, he affirmed that there were certain fundamental tasks to guarantee success in quality such as commitment to quality, each department must be committed to improving quality, determining current and potential quality problems, evaluating in a timely manner the cost of quality, encourage the personal interest of all employees for quality, take concrete action to fix problems, institute a commission for the program "zero defects", generate spaces where staff can express to the management the obstacles faced in the development of their improvement goals, and give recognition to the most active members.

To sum up, Crosby states that quality is the result of the prevention processes. This is the method to prevent the business illness and prevent its premature demise. In that way, prevention is achieved through exercises such as training, discipline, example, and leadership, among other things. These should impact all the departments of the company.

On the other hand, Crosby's theories state that quality must be achieved through the compliance with requirements. In the quality, standard errors should not be tolerated. Errors should not be tolerated in financial management or production, to ensure success.

Crosby was a great driver of business and its development in North America. His life ended on August 18, 2001, while he was with his family in Asheville, North Carolina, United States. Crosby died due to a respiratory failure.

Kindly visit this Web Page to listen to him:

https://www.youtube.com/watch?v=RznQBpqi4dg

''The Quality Man'' Philip Crosby Explains Absolutes of Quality Management.

Please visit these Web Pages to know him MORE!

01] https://asq.org/about-asq/honorary-members/crosby

02] https://en.wikipedia.org/wiki/Philip_B._Crosby

03] https://opexlearning.com/resources/philip-crosby-contributions-to-the-theory-of-process-improvement-and-six-sigma/27873/

04] https://asq.org/quality-progress/articles/philip-b-crosbys-mark-on-quality?id=dc73c10ba175431ebe4f87a93f37e5c6

05] https://www.toolshero.com/toolsheroes/philip-crosby/

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ZERO DEFECTS

Zero Defects Philosophy

Philip Crosby

What is Zero Defects?

Zero defects are a philosophy founded on the idea of getting things right on the first try. Designed to work for all industries, this all-encompassing philosophy aims to improve efficiency and increase profit for businesses by eliminating the cost of their mistakes. It can lead to better customer satisfaction, a change in perspective, and a continuously improving work environment.

History

The idea of zero defects started with Philip Crosby, a well-known American quality professional. He perpetuated the idea that quality should be invested in the most, as "quality is free." He believed that investing in quality meant that one should do things right on the first try to assure themselves of a high-quality outcome immediately.

Crosby didn't give hard rules for achieving one's standard of quality, declaring quality is neither tangible nor intangible. Quality, he said, was simply about conforming to an organization's standards and requirements to the best it can be. To achieve this, he placed heavy emphasis on preventing waste when performing essential tasks. Waste here was defined as anything unproductive or inessential to a task, such as certain processes and tools. Prevention was better than cure, and by doing things right the first time and avoiding mistakes, a high standard of quality can be achieved.

Zero defects theory should not be confused with perfectionism, however. The philosophy of zero defects doesn't mean that people never make mistakes. Instead, it means that companies shouldn't be working with the idea that not giving one's best is the norm. Substandard and unclear targets where the final product can just be fixed later should not be expected; instead, management should work to create things right on the first try with clear targets to produce their ideal outcomes.

Today, zero defects are the leading philosophy behind many total quality management and assurance programs across different fields. Together with the Six Sigma concepts and the 5W1H method, it promotes continuous improvement throughout the workplace, ensuring that the standard of quality increases with time, as well as the standard of leadership.

Achieving the ZERO Defects

14 Steps to Zero Defects

Although Crosby did not give clear definitions for quality, he laid out 14 steps to achieving zero defects for quality improvement that can be used by anyone. These are:

1. **Management commitment:** The desire for change should start with leadership. Management must be the first ones to commit to zero defects before cascading it down to the others.
2. **Quality improvement team:** Once management has committed to the task, they should form a team dedicated to total quality improvement and management.
3. **Quality measurement:** The quality improvement team and upper management should convene to define and measure quality. This can be done by identifying the target goals to achieve, what can be done to attain them, and what else can be improved upon.
4. **Cost of quality evaluation:** Identify and understand the cost of the goal you want to achieve. The team should discuss how this affects their organization's other goals, and see if this standard of quality is something attainable given their other tasks.

5. **Quality awareness:** The definition and measures of quality should be known by everyone in the organization and not just the quality improvement team. Everyone should be aware of what quality means for the organization and gain an understanding of it so they can also work towards it.
6. **Corrective actions:** Now that costs and issues of quality control have been discussed, the members of the organization must work together to create corrective measures to improve internal processes.
7. **Plans for zero defects:** After all discussions and corrective actions, it's time to establish plans for attaining zero defects. Eliminate all defects and start focusing on what is considered essential.
8. **Supervisor training:** Supervisors should be trained to implement the plans for zero defects across the organization. They should understand what the philosophy of zero defects is and should be able to explain it to the other staff members as well as carry it out themselves.
9. **Zero defects day:** Holding a "zero defects day" is one way to ensure everyone in the organization is aware of the plans and philosophies in place to eliminate defects. On this day, managers and supervisors come together to discuss the plans for zero defects, ensuring everyone is on the same page.
10. **Goal setting:** Management should set goals related to zero defects not only for the organization but also for the teams under it and the employees within them as well.
11. **Error cause removal:** Supervisors and managers should ask their staff for any other issues they encounter that cause them to make mistakes. It's not uncommon that errors or hindrances to achieving zero defects that are only noticed while working or after initial planning. Discussing them as a group is a good way to identify them and find solutions that can also be adopted by other staff or teams later on.
12. **Recognition:** It's essential to give proper recognition to those who follow zero defects plans well. Celebrating their success not only encourages them to keep it up, but also motivates others to do the same.
13. **Quality council:** After implementing zero defects plans, managers should convene a quality council to analyze their efforts and the results. The quality council should be composed of quality professionals and internal team leaders, and they should meet regularly to better observe the organization and see if the defined standard of quality is being met along with the company goals.
14. **Repetition:** Ensuring quality is maintained and controlled is not a one-time thing. The philosophy of zero defects is easy to understand, but it will not take effect immediately.

It will require trial and error and many discussions, and will constantly require changes as work processes and needs are always changing. Thus, established plans for zero defects should be analyzed regularly to see if they are still relevant and if there are any new issues or errors to address.

[Resource: https://safetyculture.com/topics/zero-defects/]

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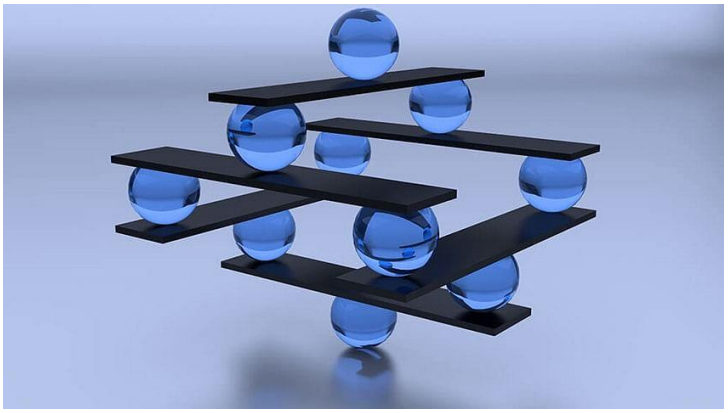
The Concept of Zero Defects in Quality Management

Author: Simplilearn

(https://www.simplilearn.com/concept-of-zero-defects-quality-management-article)



Zero Defects, a term coined by Mr. Philip Crosby in his book "Absolutes of Quality Management," has emerged as a popular and highly-regarded concept in quality management – so much so that Six Sigma is adopting it as one of its major theories. Unfortunately, the idea has also faced a fair degree of criticism, with some arguing that a state of zero defects cannot exist. Others have worked hard to prove the naysayers wrong, pointing out that "zero defects" in quality management doesn't mean perfection but rather relates to a state where waste is eliminated, defects are reduced, and you are maintaining the highest quality standards in projects.

What Do We Mean by Zero Defects?

Zero defects is a mindset that emphasizes the importance of getting things right the first time. It aims to eliminate defects, improve product or service quality, and reduce costs associated with waste.

From a literal standpoint, it's pretty obvious that attaining zero defects is technically not possible in any sizable or complex manufacturing project. According to the Six Sigma standard, the definition of zero defects is defined as 3.4 defects per million opportunities

(DPMO), allowing for a 1.5-sigma process shift. The zero defects concept should pragmatically be viewed as a quest for perfection in order to improve quality in the development or manufacturing process. True perfection might not be achievable but at least the quest will push quality and improvements to a point that is acceptable under even the most stringent metrics.

How to Adopt a Zero Defects Approach

A zero defects approach is a quality management philosophy that aims to eliminate errors and defects in all production or service delivery stages. Below are some steps that can help you adopt a zero defects approach:

1. Create a culture of quality: Emphasize the importance of quality throughout the organization. Train employees to focus on quality in every aspect of their work and encourage them to take pride in delivering defect-free products or services.
2. Establish clear quality standards: Define quality standards for all processes and products, including metrics to measure and monitor quality. Ensure that everyone in the organization understands and follows these standards.
3. Identify potential defects: Conduct a thorough analysis of all processes and products to identify potential sources of defects. This can include analyzing customer feedback, conducting quality audits, and reviewing production processes.
4. Develop preventative measures: Once potential defects are identified, develop preventive measures to eliminate or reduce the risk of defects occurring. This can include implementing quality control measures, improving training programs, and using more reliable production processes.
5. Monitor and measure quality: Continuously monitor and measure quality to ensure that processes and products meet established quality standards. Use data and feedback to identify areas for improvement and adjust processes as needed.
6. Encourage continuous improvement: Continuously look for ways to improve processes and products to achieve even higher levels of quality. Encourage employees to provide feedback and ideas for improvement.

Also, kindly refer to the following Web Pages

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02] https://www.tutorialspoint.com/the-concept-of-zero-defects-in-quality-management

03] https://staragile.com/blog/zero-defect-concept

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05] https://en.wikipedia.org/wiki/Zero_Defects

06] https://www.velaction.com/zero-defects/

07] https://www.sciencedirect.com/science/article/pii/S0166361521002037

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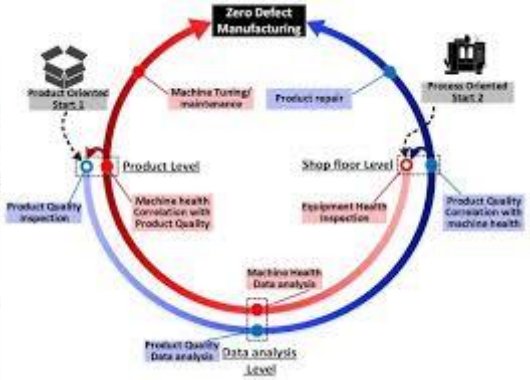

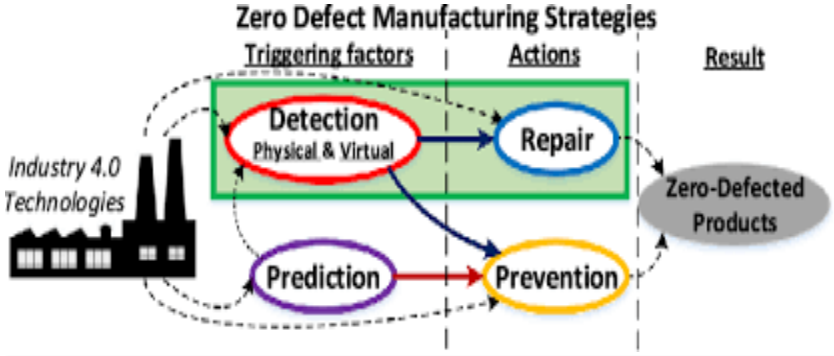

ARCHITECTS OF QUALITY

TEN GURUS

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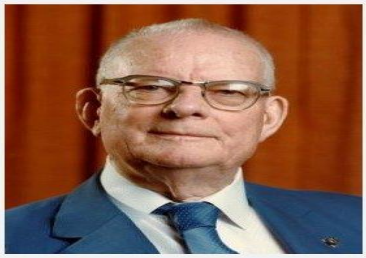
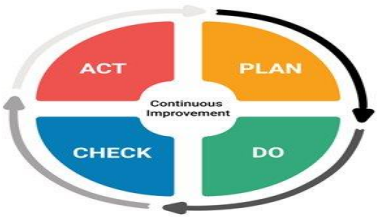
By definition, a guru is someone who is both kind and smart, and who also teaches others. In addition to these qualities, a quality guru should have a groundbreaking approach to quality in the corporate world.

Quality management is the practice of managing the whole production process to produce an excellent (quality) product or service. Quality management focuses on the customer and meeting the customer's needs, and everyone in the firm is responsible for the quality of the product. The basic quality management principles are: quality, teamwork, and proactive management. Quality management is not a single doctrine derived from a particular individual or idea—it is a collection of ideas—but there is a core group of contributors known as the Quality Gurus. These are (1) Dr. W. Edwards Deming, (2) Dr. Joseph Juran, (3) Dr Philip B Crosby, (4) Dr Shigeo Shingo, (5) Dr. Genichi Taguchi, (6) Dr. Kaoru Ishikawa, (7) Dr Armand V. Feigenbaum, (8) Dr Taiichi Ohno and (9) Walter A Shewhart. The Quality Gurus have all had a significant impact on the world through their contributions to improving not only businesses, but all organizations including state and national governments, military organizations, educational institutions, healthcare organizations, and many others.

No one can deny the crucial responsibilities played by quality experts (gurus) in expanding and transforming the idea of quality from a narrowly focused technical system to a more comprehensive body of knowledge known as overall quality with implications for management in production. TQM was first developed in Japan after WWII thanks to the work of quality experts like Deming and Juran. Eventually, influential business thinkers like Crosby, Feigenbaum, Ishikawa in and others refined this management strategy to dramatically enhance company quality. TQM gurus' proposals and theories led to the creation of several national as well as international quality awards (QAs) in the 1980s and 1990s, all with the aim of providing criteria for TQM implementation.



W. Edwards Deming



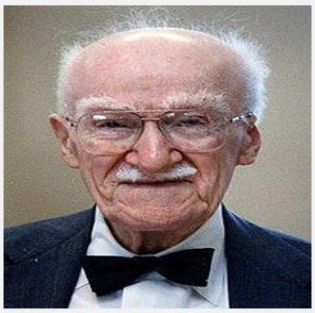
W. Edwards Deming believed that management, both at the individual and organisational levels, was responsible for 94% of quality issues. His fourteen-point plan is an all-encompassing management philosophy applicable to businesses big and small, in the public sector as well as the private and service industries.

With his "Deming Cycle," "Fourteen Points," and "Seven Deadly Diseases", Dr. W. Edwards Deming has become the most important quru of management of quality in the United States and Japan. Deming earned degrees in engineering and physics from both Yale University and the University of Wyoming. While working at Western Electric, he was inspired by Dr. Shewhart's conceptual vision for quality to create the control chart and the PDSA cycle (Shewhart cycle). After Deming left Western Electric, he applied the PDSA framework (Shewhart cycle) he had devised to "clerical activities." At the United States Department of Agriculture, he was a trailblazer in the use of statistical and sampling techniques from 1927 until early 1940. Both the War Department with the Census Bureau used Deming during World War II to adopt control charts and sample methodologies. The Japanese businesses he consulted with after the war benefited greatly from his expertise in quality assurance.

In the early 1950s, Japanese goods were notorious for their high failure rates and low quality in comparison to those of other nations. He told the Japanese that "numbers may be utilised to regulate that process", emphasising that "process" is where most manufacturing problems arise. Deming's consulting work for the Japanese economy had very favourable effects on the country's goods and services. Soon, he was hailed as a local hero. The "Deming Prize" was founded by JUSE in 1951 to recognise Deming's contributions to Japan. The "Second Order Ribbon of the Sacred Treasure" was bestowed to him by Emperor Hirohito in 1960.

The PDCA cycle, which is based on the Shewhart cycle (PDSA) that was established by Deming is a crucial framework to guide improvement for quality and productivity. DMAIC (Six Sigma) as well as DMADV (DFSS) added the rigour of a project's life-cycle (PLC) to the launch and completion of Six Sigma projects, and RADAR (the EFQM Excellence framework) has been used to evaluate business effectiveness. The "Plan-Do-Check-Act" (PDCA) technique is one way that management system standards like ISO 9001 may help businesses become more effective at meeting their customers' needs and achieving their quality goals.

Deming was vague about what constituted quality. In his "renowned system diagram," Deming argues that the consumer should be the only arbiter of quality. The consumer has a pivotal role in both the beginning and end of his system. Deming's ideas and concepts were incorporated in the creation of the ISO 9000 family of quality standards, and they even ushered in a new era in supply and chain management.



Joseph Juran

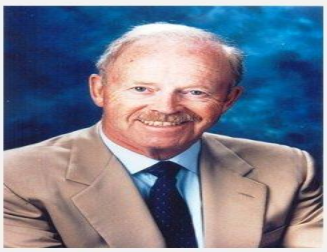
Dr. Joseph M. Juran has had more impact than any other expert in quality management, including Deming. He focused more on the management side of quality assurance. The book "Quality Control Handbook" by Juran, originally published in 1951, established him as a pioneer in the field of quality management. Beginning his career as an engineer in 1924 with Shewhart's group at the Bell System, where he was most noted for his contributions to quality improvement, Deming eventually departed Western Electric after World War II to establish his own institution. He was the second American guru to be brought to Japan in 1954 by JUSE to teach and supervise "quality control courses" to the country's top business executives, after Deming. His lectures introduced and emphasised the managerial aspects of planning, organising, and controlling, and they centred on the responsibility of leadership to achieve quality as well as the need for setting goals; this is why he emphasised a managerial approach to a similar analogy for better quality results through three basic processes or "Juran's Trilogy," which together form a successful framework for Total Quality Management to obtain quality goals and improve quality.

(i) Quality planning: a) Set targets for improved quality. b) Determine your target audience. c) Find out what your consumers want. d) Create enhancements to the product in direct response to user feedback. e) Find ways to manufacture the product's characteristics. f) Put controls in place for the process, then implement the plans. **(ii) Quality control:** a) Examine the results in the real world. b) Check actual results vs expected ones. c) Take advantage of the gap. **(iii) Quality improvement**: a) Put up evidence why it is necessary. b) Get the groundwork laid. c) Find the enhancement initiatives. d) Set up your project groups. **(iv) Provide the teams with resources, training, and motivation to**: a) Determine the root cause(s), and b) Rev up the treatments. Put safeguards in place to preserve the progress.

Effective quality management requires the systematic preparation, enhancement, and regulation of quality-related activities. Process control is established at an agreed-upon level of quality performance; from there, project-specific enhancement strategies are developed and implemented.

To boost customer happiness, he presented the "Ten Steps to Quality Improvement," which include the following: 1. Create an understanding of the potential for change; 2. Make plans for betterment; 3. Establish a quality council, pinpoint issues, choose projects, assign individuals to teams, and choose leaders; 4. Offer instruction; 5. Create and implement plans to address issues; 6. Provide updates; 7. Show appreciation; 8. Share your findings; 9. Do the math and; 10. Keep the ball rolling by integrating continuous improvement into your company's everyday operations.

He focused on both external and internal clients, not only the final buyer. From the initial product developer to the end consumer, everyone in between is a supplier or a customer. Furthermore, the individual will be a process, engaged in some kind of change or action.



Philip Crosby

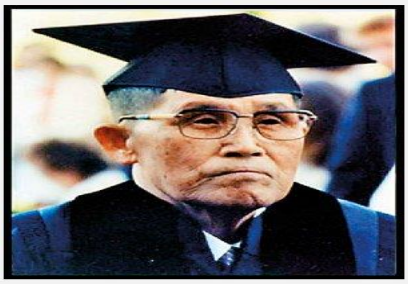
Philip Bayard Crosby is widely recognised for his "Zero Defects" and "quality is free" theories. He held that an effective quality management must be "based on prevention- based system" and that errors can arise from a lack of employee knowledge and focus. According to Crosby, "quality is not compared," adding that "quality in terms of goodness, feel, elegance, and richness" do not exist. Crosby's four absolutes, drawn from his Total Quality Management philosophy, are summarised below in light of his notion of "Zero Defects."

a) Conformance to requirements is the definition of quality, not goodness or elegance.
b) A quality system is one that emphasises prevention rather than evaluation. Good quality management (TQM practises) may help avoid potential problems;
c) The goal should be "Zero faults" in terms of quality performance, although anything near would do. Rather than "that's near enough," It is unacceptable to make mistakes and;
d) The cost of nonconformance is the true quality indicator.

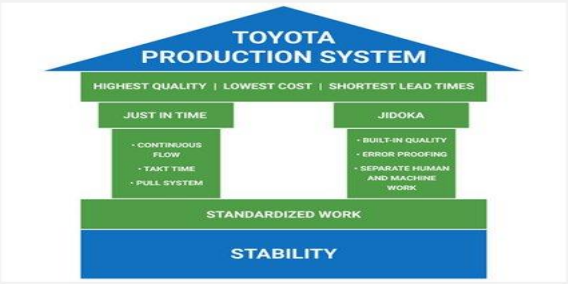
Crosby said that management is responsible for 80 percent of an organization's quality issues, hence their focus should be on fixing such issues. In the same vein as Deming and Juran's suggestions for enhancing quality, Crosby proposed a set of 14 directives for business leaders to follow.

1. To make it apparent that management is committed to quality; 2. To raise the standard of cross-departmental collaboration, "quality improvement team" means: 3. Measuring performance in order to guarantee quality enhancement is what we mean when we say "quality measurement." 4. Quality cost measurement inside an organisation for management purposes; 5. "Quality awareness" means raising workers' level of understanding about quality. 6. "Corrective action": to offer a methodical approach to resolving issues. 7. "Zero defects action" means showing unwavering dedication to the zero faults initiative. 8. Employee training: identifying the most effective ways to improve the quality of training for managers. 9. "Zero Defects Day" is an initiative aimed at making the "Zero Defects" (Do the right things at the right time) message tangible to all workers. 10. "Goal setting": allowing everyone in the office to set personal and team objectives for betterment; 11. The goal of "error-cause elimination" is to ensure that all employees are effectively communicating with management in order to identify quality issues and provide workable solutions. 12. "Recognition": expressing gratitude to those who have carried out their responsibilities with excellence; 13. "Quality councils": to form quality councils for frequent communication, and; 14. Repeat the process to demonstrate to your staff that your commitment to quality improvement is ongoing.

Crosby defined the several stages of management of quality maturity, which may be used to evaluate an organization's level of excellence management development. These are the five stages of quality management maturity:
1. Unpredictability; 2. Awaking; 3. Illumination; 4. knowledge and 5. assurance.
Several other metrics, including management comprehension and attitude, quality organization status, issue handling, cost of quality as a proportion of sales, and total firm quality posture, may be used to evaluate the business's progress through these phases.

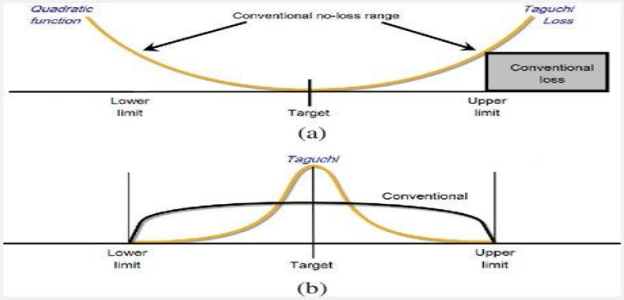


Shigeo Shingo



When it comes to Just-in-Time production, he is almost synonymous with the concepts of the Poka-Yoke (error proofing) system and the single minute exchange of die (SMED) system. Defects are investigated, production is halted, and quick feedback is provided via Poka Yoke to help pinpoint and eliminate their causes. The inclusion of a checklist acknowledges that people are fallible and forgetful. The goal of Poka-Yoke is to prevent mistakes from evolving into defects, which he differentiated from "errors," which are unavoidable but do not reach the consumer. There is a cause-and-effect link between human mistake and the presence of defects. Poka-Yoke & source inspections are necessary for the ideal manufacturing system of zero quality control. In the latter, mistakes are examined before they can become faults, and either the system is put on hold while the problem is fixed, or the incorrect condition is modified automatically.

Genichi Taguchi

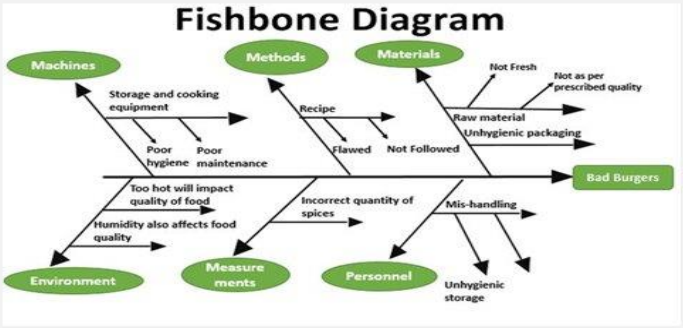


Dr. Genichi Taguchi argued that rather than trying to control all the various variations that occur during real production, it is better to create a product that is resistant or insensitive to variations in the process of production. He did this by taking previously existing information about experimental design and making it more accessible and applicable for quality professionals, therefore putting the theory into practise. He divided off-line quality in three stages: design, development, and production. This shifts the focus of quality and dependability back to where it belongs: the design phase.

i. System design
ii. Parameter design
iii. Tolerance design

Taguchi technique is essentially a prototype process that helps designers determine the best parameters for making a product that will last through several iterations of production and still satisfy the needs of the end user. Taguchi methodologies, which may be seen along a continuum, are now closely linked with quality function deployment (QFD) in the eyes of many businesses.

Kaoru Ishikawa



Among Dr Kaoru Ishikawa's numerous contributions to quality management are the following: the "seven fundamental tools of quality" framework, the "whole quality perspective," company-wide quality control, a focus on the human element of quality, the Ishikawa diagram" or the Ishikawa diagram.

i. Pareto analysis = which problems are big?

ii. Cause and effect diagrams = Causes of problems?

iii. Stratification = How data is made up?

iv. Check sheets = How often it is done? Or occurs?

v. Histograms = How do overall variation looks like?

vi. Scatter charts = What is the relationship among factors?

vii Process control charts = Which are the variations who controls and how?

He felt that these seven methods should be well-known across an organisation and utilised to diagnose issues and provide solutions. When combined, they make for a formidable toolbox.

i. Venn diagram;

ii. Inverse causation chart (Ishikawa chart);

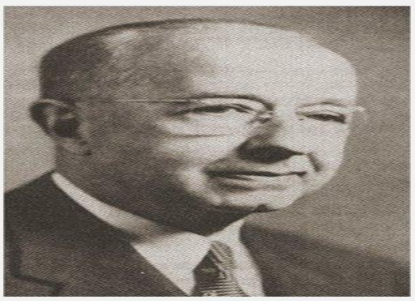
iii. Grouping diagram;

iv. The scatter plot;

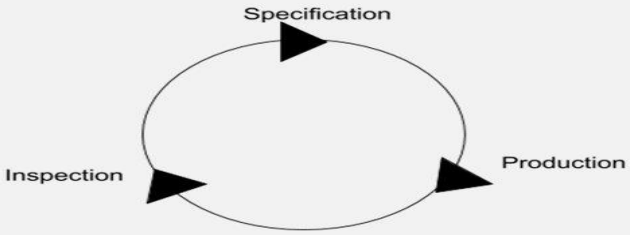
v. a checklist;

vi. and the histogram;

vii. Calliper of control



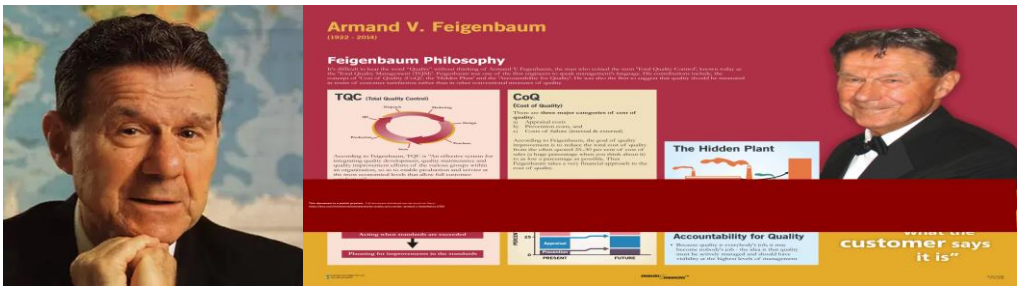
Walter Andrew Shewhart



The term "statistical process control" was used by Walter Shewhart to describe the practice of using statistical techniques to monitor and regulate industrial processes in order to create things with consistent quality. Shewhart also proposed the use of "control charts," graphical aids for tracking a process's results over time and seeing when things have gotten out of hand. His concepts have had a major impact on the evolution of quality assurance practices in a variety of businesses throughout the globe.

Taiichi Ohno

Japanese industrial engineer & businessman Taiichi Ohno is credited for helping create the Toyota Production System (TPS). Ohno pioneered the TPS, an approach to production that seeks to eliminate inefficiencies and waste. Both the "just-intime" manufacturing strategy of making just what is required at any given moment and the "kanban" system are often attributed to him. This visual communication system is used in factories to facilitate the smooth movement of products. Many businesses throughout the globe have implemented some of Ohno's suggestions, which have greatly influenced the manufacturing industry.



Armond V Feigenbaum

Dr. Armand V. Feigenbaum was a quality expert from the United States. His time at GE shaped his ideas into something really groundbreaking. complete quality management, often known as complete quality control, was first proposed by him. He described it as "an effective system for combining quality growth, quality maintenance, and quality improvement activities of the different units within an organisation to enable manufacturing and client service at the most affordable levels that allow maximum customer satisfaction."

Total quality management (TQM), the current iteration of total quality control, has been extensively adopted as a viable operational philosophy across all economic sectors and is almost synonymous with Feigenbaum's name.

In 1951, Feigenbaum released his first book, the "Quality Control Handbook," and became known as the "guru" who first presented the notion of "Total Quality Control" (TQC). The Japanese adopted this outlook, along with the notion of "Company Wide Quality Control," in the 1980s. His theory is on a "prevention-based approach" that places a premium on designing high-quality products and services and optimising the processes at their origin. To ensure that the goods are in line with "pre-defined standards" (such ISO 9000), this approach relies on documentation and audits. The importance of everyone in the company, from secretaries to engineers to factory employees, was something that Feigenbaum emphasised as well.

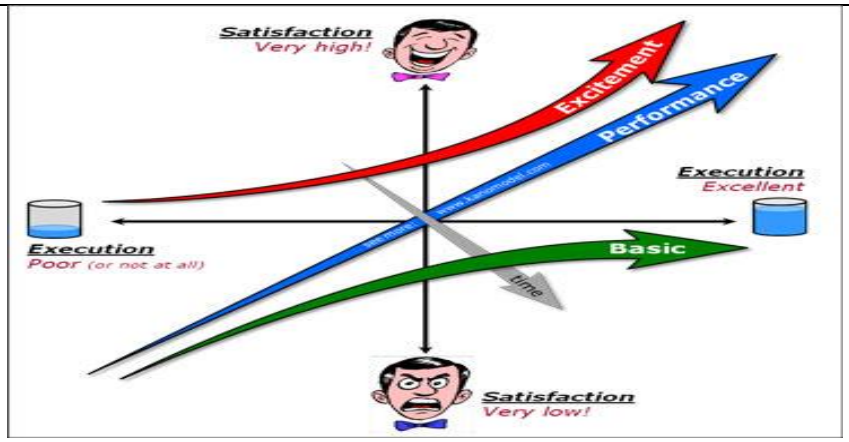
The fundamental ideas of Feigenbaum's systematic approach for quality as follows: (i). Quality is an organisational endeavour; (ii). What a consumer values most is what defines quality. (iii). Price and value are inseparable; (iv). Excellence calls for fierce devotion from every member of the team. (v). Managing with quality is an approach. (vi). Innovation and quality go hand in hand; (vii). Integrity in production; (viii). Constant refinement is essential for quality; (ix). Productivity may be increased with the least amount of money and resources spent on it by focusing on quality, and (x). Quality is achieved by a comprehensive system that involves both clients and vendors.

He emphasised "a system approach to quality," also known as "TQC," which consists of the following major phases for effective quality management:

Setting quality standards:

i. evaluating how well something fits these criteria;
ii. responding when expectations aren't reached, and;
iii. Efforts are being made to raise these benchmarks.

Noriaki Kano



Dr. Noriaki Kano is the only professional in the world who is Honorary Member of International Academy for Quality (IAQ), American Society for Quality (ASQ) and Japanese Society for Quality Control (JSQC) the three most prestigious quality societies of the world. This is the highest honor these societies bestow on quality professionals. He is honorary member of many societies of quality professionals in Europe, Asia and Americas; and visiting professor at various prestigious universities in Europe, USA and Asia.

Dr. Kano is the founding President of the **Asian Network for Quality (ANQ) and Honorary Chairperson since 2005.** He has been Board Member of **Union of Japanese Scientists and Engineers (JUSE) since 2011** and The Overseas Human Resources & Industry Development Association **(HIDA) (2007-12)** the two most prominent organizations promoting quality in Japan and overseas.

Prof. Kano is an honorary advisor to various quality bodies of other countries like China and India and has **made positive contribution for development of quality around the world providing consultation, keynote speeches and conducting seminars in 84 countries.**

Prof. Kano has been the Chairman of the selection committee for Deming Prize for individuals since 2011 and Chairman of Deming Application Prize Committee for two terms ie. 2004 to 2007. These are considered the most prestigious awards in the field of quality management in the world.

Accomplishments:

Dr. Kano has been **Board Director of Komatsu Ltd.** for 6 years and been **Corporate Auditor at Sekisui Chemical Ltd.** for 6 years. A very rare accomplishment indeed.

He is best known for development of **Attractive Quality Creation that is popularly known as Kano Model / Method** and very widely used around the world in development of new products and services in all sectors of economy. Another important approach developed by Dr. Kano for breakthrough improvement is called the Task Achieving QC Story. He has **published** over 300 papers and books including "Attractive Quality" (Kano Method / Kano Model)", "Guide to TQM in Service Industries" (in English) and "Way to Breakthrough and Creation" (in Japanese)

Dr. Kano has helped many **multinational companies from Japan, USA, Europe, Taiwan, Thailand, China and India** besides other countries to enhance their business performance using quality management approaches.

Dr. Kano continues his **research activities** to find new ways to improve organizational performance based on quality management theory and practices. Over the last 4 to 5 years he is **developing new methodologies and tools that enable effective use of Information and Communication Technologies (ICT)** to make breakthrough improvements. He develops these methods jointly with his client organizations. In some countries similar methodologies are called Quality 4.0. He is ahead of the rest in this field.

Honors:

Eponymous Dr. Kano has the unique distinction of Awards being established in his name:

- 2010 Ishikawa-Kano Award Established by Asian Network for Quality (ANQ)
- 2009 Kano Quality Award Established by Technological Promotion Association (TPA, Thailand)

Following is some important Web Pages which contain more useful/interesting INFO

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01] https://www.qualitygurus.com/9-quality-gurus-and-their-contributions/

02] https://www.bizmanualz.com/improve-quality/who-are-the-top-quality-gurus.html

03] https://www.linkedin.com/pulse/architects-quality-meet-9-gurus-qualitygurus-com

04] https://iaeme.com/MasterAdmin/Journal_uploads/IJM/VOLUME_10_ISSUE_5/IJM_10_05_036.pdf

05] https://www.focusstandards.org/quality-gurus-key-contributions/

06]https://irgst.org/articles.aspx/2571/Quality%20Gurus%20and%20their%20Contributions

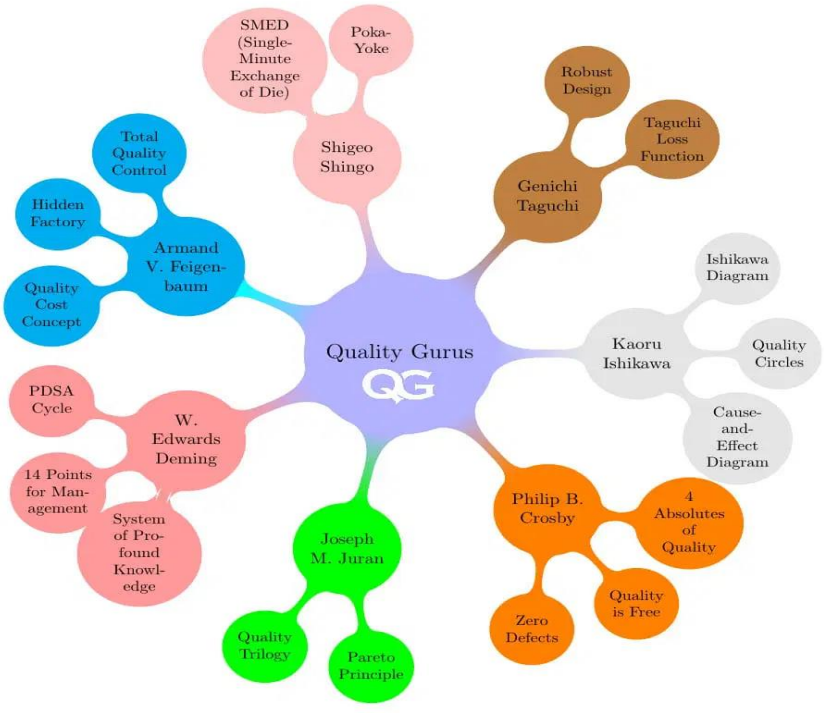
07] https://www.scribd.com/doc/45079947/Top-Ten-Quality-Gurus

08] https://www.linkedin.com/pulse/quality-gurus-abdur-rahman-farooq

09]https://www.encyclopedia.com/management/encyclopedias-almanacs-transcripts-and-maps/quality-gurus

10] https://better-operations.com/2013/02/26/quality-gurus-on-quality-management/

11] https://isqnet.org/about-us/governing-council/dr_noriakiKano.html



Quality is Free

The 14 Steps

Deming's 14 points v. Crosby's 14 Steps

{https://www.benchmarksixsigma.com/forum/topic/39289-demings-14-points-vs-crosbys-14-steps/}

Crosby's 14 Steps is a guide for top management to initiate a quality improvement program in the organization towards a world class quality. It focusses on long term employee participation and relies on the thought that any money spent on quality improvement is money well spent.

Deming's 14 Points or Deming Model of Quality Management is a set of principles to optimize the quality and productivity of organizations. These 14 points help in implementation of Total Quality Management (TQM) in the organization.

An application-oriented question on the topic is posed by:

Vishwadeep Khatri

Both Deming and Crosby gave their own 14 point / step philosophy for business excellence.
What is the similarity and differences in the two approaches?

The best answer was provided by Sandip Mittra on 4th Jan 2022.

Quality is key to success. Most of us try to measure the quality of the final product which goes to the customer and improve them. However, we fail to realize that quality is important in each step and everything a company does. It can be accounts, procurement, delivery, sales and all other processes. There are many theories, methods and tool provided by several scholars on how to improve quality. Out of all the tools and theories, we are going to understand 14 principles laid down by Dr. Deming and by Philip Crosby.

Deming's 14 Points for Total Quality Management (TQM)

Deming in his book titled "Out of Crisis" has explained about his philosophy in details. This was mainly focused to manufacturing industries but can be used in any business.

Crosby's 14 Steps to Improvement

Philip Crosby on other hand provided 14-step quality improvement program which is more focused on how the employee understands what quality means & partner the quality movement.

Below are the 14 steps or Points for Quality Improvement

S. No	Crosby's 14 Steps	Deming's 14 Points
1	Management Commitment	Create a Constant Purpose Toward Improvement
2	Quality Improvement Team	Adopt the New Philosophy
3	Quality Measurement	Stop Depending on Inspections
4	Cost of Quality Evaluation	Use a Single Supplier for Any One Item
5	Quality Awareness	Improve Constantly and Forever
6	Corrective Action	Use Training on the Job
7	Plan for Zero Defects Program	Implement Leadership
8	Supervisor Training	Eliminate Fear
9	Zero Defects Day	Break Down Barriers Between Departments
10	Goal Setting	Get Rid of Unclear Slogans
11	Error Cause Removal	Eliminate Management by Objectives
12	Recognition	Remove Barriers to Pride of Workmanship
13	Quality Council	Implement Education and Self-Improvement
14	Do It Over Again	Make "Transformation" Everyone's Job

Though both Deming and Crosby focused on improving quality, there are some similarities and differences in their thoughts and approach.

Similarities:

- Management commitment is important
- Continuous improvement
- Customer focused
- Supervisor or manager responsibilities
- Quality improves profit
- Radical change in value

Differences:

- Roadmap
  - Deming: - No start and end point
  - Crosby: - Have start and end point
- Workers
  - Deming: - Variance is not largely affected by workers
  - Crosby: - Workers need to be motivated to produce zero defects

· Management
- Deming: - Major threat to managers
- Crosby: - Not many changes in the thoughts of a manager and worker

· Implementation
- Deming: - Difficult to implement as it requires huge structural change
- Crosby: - Comparatively easy to implement

Conclusion:

In today's world almost all the organization is taking up the best characteristics of these steps and framing their own structure which suits their business requirement. However, if Deming's steps are implemented then the organization can have the best impact.

Crosby's 14 Steps for Improvement

https://vireton.com/crosbys-14-steps-for-improvement/

One of the most widely discussed models in the area of quality improvement is Crosby's 14 steps for improvement. The model was developed by the quality guru Philip Crosby and promises process improvement over the long term.

The 14 Steps to Quality Improvement are as follows:

Step 1: Management Commitment

First of all, management must be committed and dedicated to process improvement and this culture should be passed on to the whole company workforce.

Step 2: Quality Improvement Team

Secondly, a team specialized in total quality management should be formulated. This team should be solely responsible for process quality.

Step 3: Quality Measurement

Before you start implement any action plan, you need to measure and assess process quality and identify the areas that need improvement.

Step 4: Cost of Quality Evaluation

Next, you need to assess the cost that comes along. What is the cost of quality and how does it fall into your company's overall plan? You can model

this as a new business scenario with multiple costs and benefits using our scenario building capabilities.

Step 5: Quality Awareness

At this point you need to spread the importance of quality throughout your entire workforce and embrace it within your business culture.

Step 6: Corrective Action

Having identified what needs to be improved, you will then need to start implementing a plan so that corrective actions start to roll out.

Step 7: Plan for Zero Defects Program

It goes without saying that this step is all about eliminating defects. This step not only aims to reduce defects but to entirely eliminate them.

Step 8: Supervisor Training

In order to achieve process quality, you need to have supervisors that are actively embracing this culture; and to do that you need to provide them with the right training.

Step 9: Zero Defects Day

Further you need to increase awareness by holding a zero defects day in which are employees are taking part.

Step 10: Goal Setting

Setting goals for improvement should involve employees from the whole organization. By engaging everyone you are making sure that goals are made out clear to all levels of the organizational structure.

Step 11: Error Cause Removal

In every quality improvement effort it is important to take a step back and identify any errors that are hindering this process. Engaging all employees in this procedure is vital.

Step 12: Recognition

Recognizing employees that excel in the quality improvement efforts and celebrating their success will not only encourage them to continue the good work but it will also inspire others to start participating.

Step 13: Quality Council

Bring along specialists and hold quality councils on a regular basis in order to create focused and clearly defined goals.

Step 14: Do It Over Again

The last step of the model is very simple. Here, you need to do everything all over again from the start. Crosby's model is not an ad-hoc model but rather a process of continual process. So, make sure that you repeat this process over and over again.

* _ _ _

Note:

Crosby's 14 Steps for Improvement was an early tool used for quality improvement. However, things have moved on a lot in this area, and approaches like Six Sigma may be more appropriate in many situations.

About the Tool

Philip Crosby, quality expert and founder of Philip Crosby Associates, developed his 14 Steps for Quality Improvement and published them in his 1979 book, "Quality is Free."

Crosby recognized early on that quality in an organization is everybody's responsibility, not just that of a quality control manager. He also understood that managers need a framework that they can use to guide the process of quality improvement, and manage the inevitable changes that go along with it.

He created the 14 Steps to Quality Improvement to fulfil this need, and also developed the idea of Zero Defects, with which the 14 Steps process is linked.

Managers executing a quality initiative in any industry can use this tool to guide them through the process of improvement.

Note:

When undertaking quality improvements within your organization, you can also use tools like Deming's 14-Point Philosophy, Total Quality Management, Kaizen and Six Sigma. Refer to these models while you're thinking about your change effort.

Using the Tool

Let's look at the steps in detail, and discuss how you can apply them successfully in your organization.

Step 1: Get Management Commitment

Your first step is to gain the support of the members of the leadership team who will be involved in the change initiative. If they aren't aware of quality management (most will be), take time to explain it, and help them see why continuous quality improvement is important for the organization, for employees, and for customers.

Don't focus on motivation, or on achieving buy-in; your goal at this stage is to communicate in an honest, open, and clear way. Good communication is essential in this early stage, so articulate what you need to say clearly, and answer any questions that people have.

Step 2: Create a Quality Improvement Team

You now need to create a quality improvement team, with representatives from each of the departments participating in the quality initiative. These people should be decision makers who can commit time and resources on their department's behalf.

Create a team charter explaining the team's goal, everyone's roles, and the resources available for the initiative.

Step 3: Measure Current Quality

If you're in a manufacturing or product industry, measuring quality might be relatively easy, since metrics may already be in place. However, this might be a challenge for non-manufacturing organizations, or if quality measurements aren't already embedded. It's essential to know where you're starting from, so that you can measure progress.

Start by looking at what's going wrong in your organization. Where are the deviations from acceptable norms? Where are the bottlenecks in your processes? What are your customers complaining about? Where are errors occurring? Where are you losing money? Conduct a Cause and Effect Analysis to uncover the root causes of these problems.

You can also ask managers, supervisors, and team members to identify quality issues. What's working for them, and what isn't? How do they know when a job is done well, or whether quality is suffering? These questions can provide clues to the current state of quality.

Once you've established where your quality problems are, make sure that the results are visible. (Do this sensitively, as you want to encourage motivation and buy-in, and avoid blame.)

Step 4: Estimate Costs

Estimate, as closely as possible, your Cost of Quality (it's likely that you'll need to get help from your finance department to do this).

Use tools such as Cost-Benefit Analysis, Net Present Values, and Internal Rates of Return to examine the costs involved in the quality initiative, and to determine whether it's worth going ahead with it.

Step 5: Develop Quality Awareness

Your goal in this step is to educate everyone about how much the quality problems cost the organization.

Crosby states that this is likely the most important step in the process. Do your best to make this information clear and relevant. Use business stories, customer examples, and case studies to explain this to your team.

It's important to strike the right tone here. Your goal isn't to scare or manipulate people, you simply want to communicate, in a positive way, why change is important.

Step 6: Take Corrective Action

As the quality initiative develops, employees will likely have additional insights that they might not have had previously.

Make sure that there is a plan in place for bringing these insights into the process. If immediate supervisors can't address these, pass them up until they reach a level where managers can address them.

Step 7: Create a Zero Defects Committee

Pick three or four members of your quality improvement team to research the zero defects concept, and ask them to think about whether or how you can include it in your organization's quality initiative.

If appropriate, communicate this concept to employees; they should understand what zero defects means, and why it's important for overall quality improvement. The committee also needs to brainstorm ways that you can incorporate zero defects into your organization's culture.

Step 8: Conduct Supervisor Training

Your supervisors need to know the benefits of the change initiative in detail. They must also have a thorough understanding of the initiative's goals, and of the part that they play in achieving these goals.

Make sure that all supervisors receive orientation training on these issues to explain how these concepts are going to benefit the organization positively. You may also want to include suppliers and vendors in this training, if they have a direct effect on product or process quality.

Step 9: Roll out Zero Defects Day

You should deploy your approach to zero defects to everybody in one day. This allows everyone to adopt this new attitude at the same time, and it will have a bigger impact than a gradual rollout.

Step 10: Set Goals

In this step, supervisors meet with employees, and establish 30-, 60-, and 90-day SMART goals. These goals will keep everyone focused on continuous improvement.

Try to align people's personal values with the organization's zero defects strategy using Management by Objectives ; this will help your team members understand why changes need to take place.

Step 11: Search for Errors

You and your quality improvement team need to search the organization for errors, starting with asking employees about the problems and frustrations that they face regularly.

Keep these employee surveys as straightforward as possible. Put one manager in charge of reading and responding to the submissions in each department. It's important that open communication takes place; employees should see that managers

are addressing these problems – lack of action from managers will lower morale and leave people feeling disillusioned.

Step 12: Recognize Achievements

By this stage, your people should be working to meet their goals, and they should be following the plan. Recognize the efforts of team members who meet these goals, or who do outstanding work in some other way.

Step 13: Schedule Regular Meetings

Over time, you'll need to update or revise your quality improvement initiative to compensate for changes in organizational needs or process changes. Meet regularly with your zero defects and quality teams to discuss progress and to solve any problems that may have arisen.

Step 14: Do It Over Again

Crosby states that the typical quality improvement program takes 12 to 18 months to complete. By the time the program concludes, staff turnover and a constantly changing business environment may mean that you need to do work in other areas of quality.

This means that you'll likely have to create a new quality management team, focus on new objectives, and start the process all over again. It's important to remind your team that this process of quality improvement, producing less waste, experiencing fewer defects, and saving money is continuous, and that it needs to be maintained in the long term for it to be effective.

From "Quality is Free: The Art of Making Quality Certain" by Philip Crosby. © 1979. Reproduced with permission from The McGraw-Hill Companies, Inc.

Key Points

Philip Crosby, quality expert and founder of Philip Crosby Associations, developed the 14 Steps for Quality Improvement and published them in his 1979 book, "Quality is Free."

Please visit these Web Pages

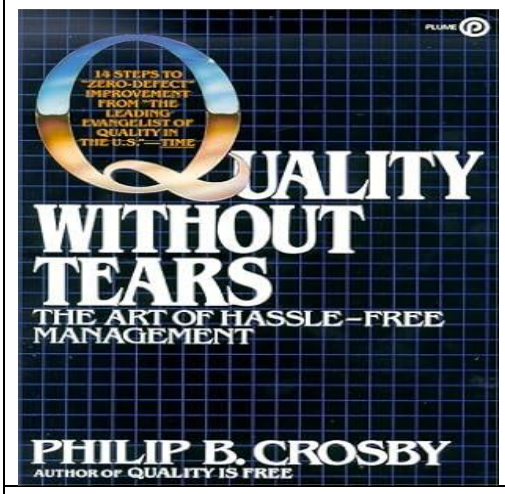
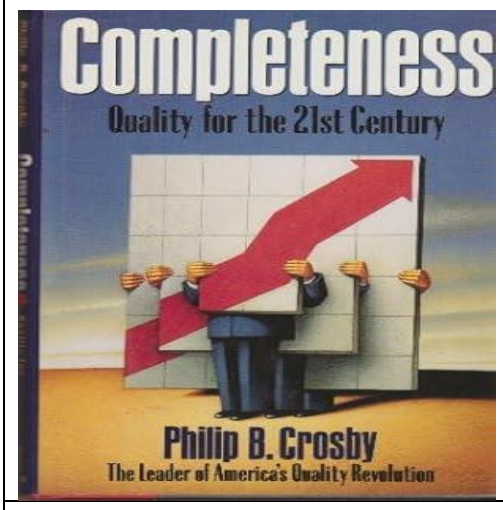
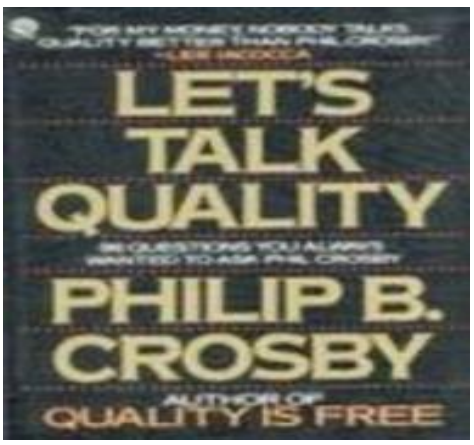
https://www.mindtools.com/a5zr4t0/crosbys-14-steps-for-improvement

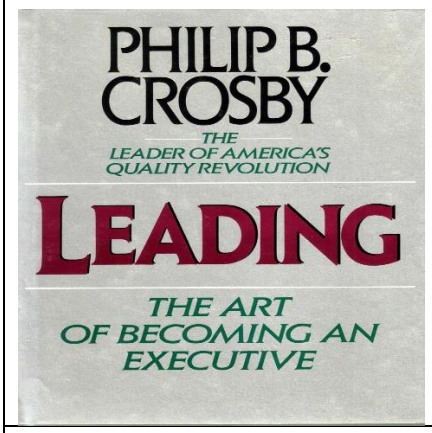
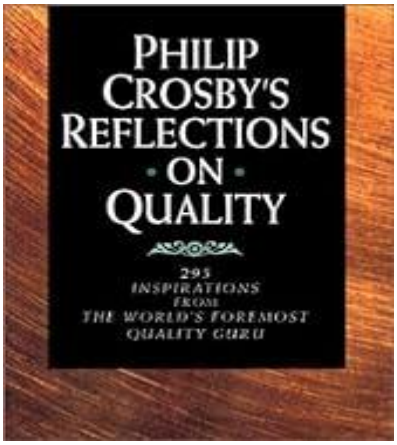
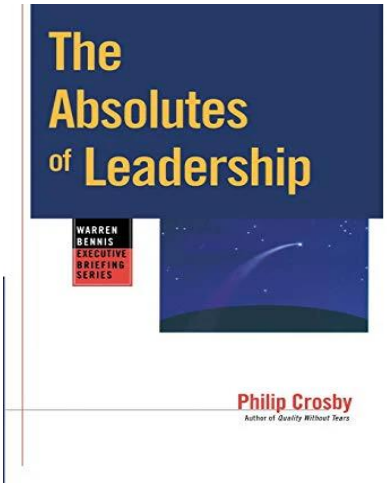
https://honable.com/crosbys-14-steps/

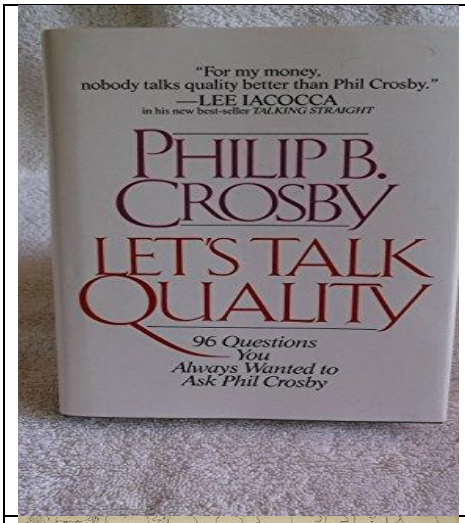
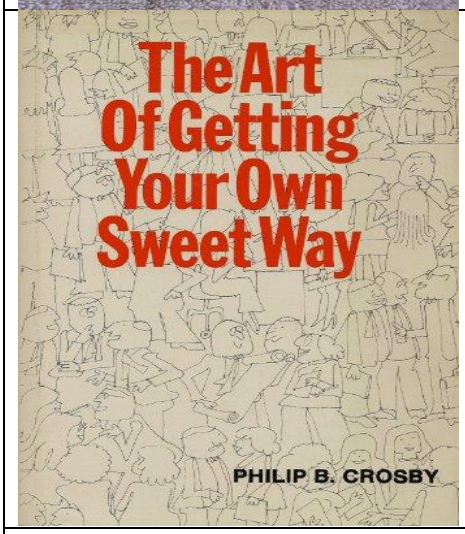
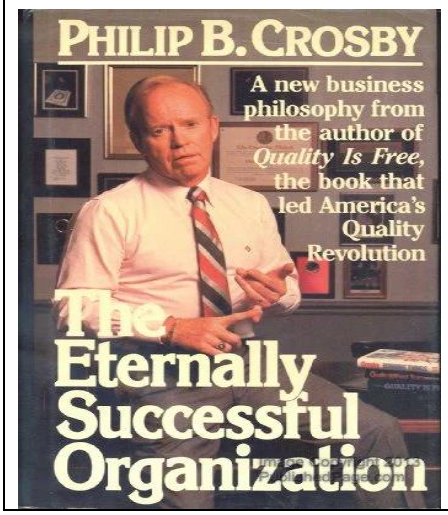
BOOKS

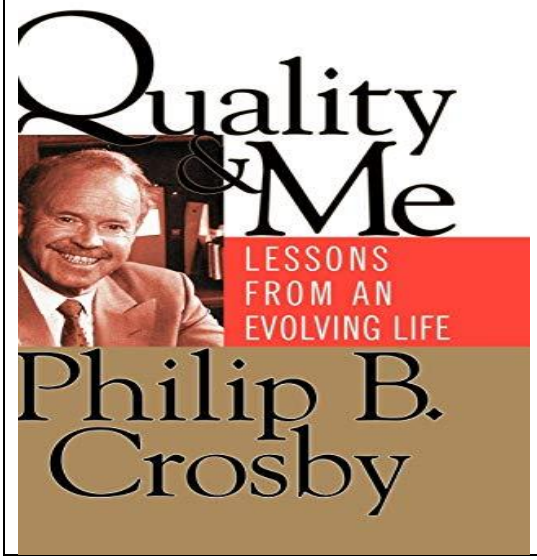
by

Philip B Crosby

	Now available in trade paperback, this mega-seller brings the timeless message of "the leading evangelist of quality" (as Time called Philip Crosby) to an ever-widening audience. Drawing on quality lessons learned from hundreds of corporate and government clients and presenting them through practical step-by-step guidance, Crosby shows managers at all levels how to build quality into all aspects of their operations.
	One of the founders of the "quality" movement in America introduces the concept of "completeness"--the idea that a successful corporation is a cohesive unit whose internal components must mesh smoothly.
	*An expert in quality management discusses the five areas of quality that have changed dramatically in the last five years, examines the relative strengths of Japanese and American management techniques, and discusses successful troubleshooting.*

	The author aims to illustrate that leadership is learnable. The text defines what constitutes a good executive and maps out the course from manager to executive combined with information on how to develop abilities such as co-ordination and delegation. The author has also written "Running Things", "Quality is Free", "The Eternally Successful Organization" and "Let's Talk Quality". A cassette is available to accompany the book.
	This is a book of 365 - one a day - inspirational one-liners. It grows out of Crosby's entire body of work, which includes thoughts not just on quality themes, but also on management and life in general. These are all based on Crosby's "Guidelines for Browsers" which are a feature at the end of all his books. This book addresses both general management issues and quality issues.
	Leadership is learnable A Warren Bennis Executive Briefing Series Book Crosby is taking his message to a different audience--a growing army of intelligent young men and women who are setting out to become executives by choice and for the right reasons. --Central Florida Business In this, his eleventh book, world-renowned consultant Philip Crosby offers readers a simple, yet ingenious method for assessing the skills of those they've been assigned to follow, as well as their own leadership abilities. Leaders, he says, come in five versions?Destructor, Procrastinator, Caretaker, Preparer, and Accomplisher. And by examining each of those character types in relation to his four Absolutes of Leadership, the author establishes a framework would-be leaders can use to build quality leadership skills of their own. Crosby also discusses the leader's role in organizational finance and quality, and in dealing with customers, suppliers, employees, and bosses. You know a leader when you meet one, he asserts and he maintains that those people who already have leadership potential will blossom once they understand and epitomize the precepts set forth in this groundbreaking work.

	This is a used book - there is no escaping the fact it has been read by someone else and it will show signs of wear and previous use. Overall, we expect it to be in very good condition, but if you are not entirely satisfied, please get in touch with us.
	This is a used book. We do our best to provide good quality books for you to read, but there is no escaping the fact that it has been owned and read by someone else previously. Therefore, it will show signs of wear and may be an ex library book
	This is a used book - there is no escaping the fact it has been read by someone else and it will show signs of wear and previous use. Overall, we expect it to be in very good condition, but if you are not entirely satisfied, please get in touch with us



Hailed by Time magazine as the "leading evangelist of quality," Philip Crosby has emerged as one of the century's greatest management thinkers. Now, in this autobiography, the person most responsible for the quality revolution in American business shares the ideas and insights he's gathered over the course of an eventful, forty-year career. A talented storyteller, Crosby recounts his years as vice president of ITT, his working relationship with the legendary Harold Geneen, and the launch--and re-launch--of his own consulting practice. Quality and Me is an intimate, informative portrait of the man who changed the way quality management is practiced tod

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- 1967. *Cutting the Cost of Quality: The Defect Prevention Workbook for Managers*. Boston: Industrial Education Institute.

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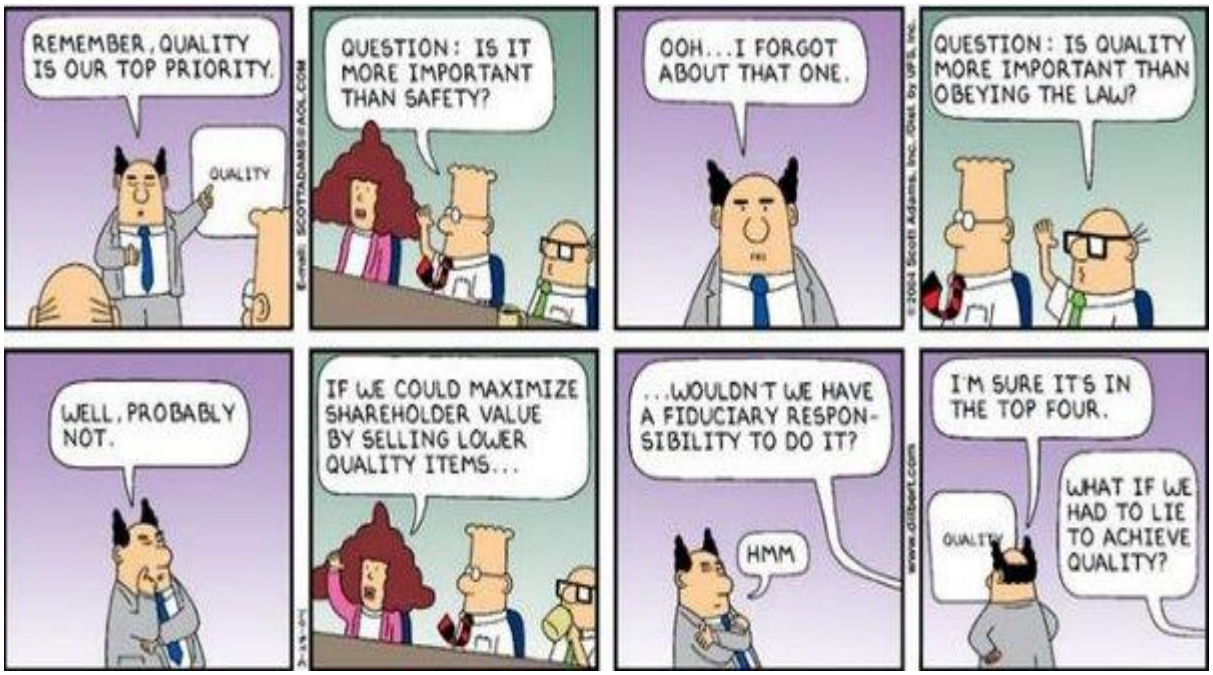

REMEMBER, QUALITY IS OUR TOP PRIORITY.
QUALITY
QUESTION: IS IT MORE IMPORTANT THAN SAFETY?
OOH...I FORGOT ABOUT THAT ONE.
QUESTION: IS QUALITY MORE IMPORTANT THAN OBEYING THE LAW?
WELL, PROBABLY NOT.
IF WE COULD MAXIMIZE SHAREHOLDER VALUE BY SELLING LOWER QUALITY ITEMS...
...WOULDN'T WE HAVE A FIDUCIARY RESPONSIBILITY TO DO IT?
HMM
I'M SURE IT'S IN THE TOP FOUR.
QUALITY
WHAT IF WE HAD TO LIE TO ACHIEVE QUALITY?

ASQ

American Society for Quality

https://asq.org/

Brief History

ASQC was established on 16 February 1946 by 253 members in Milwaukee, Wisconsin, with George D. Edwards as its first president. The organization was first created as a way for quality experts and manufacturers to sustain quality-improvement techniques used during World War II.

In 1948, ASQC's Code of Ethics establishes standards for members to conduct their activities and business. Business writer Armand V. Feigenbaum served as president of the society in 1961–63.

In 1997, the members of the organization voted to change its name from "American Society for Quality Control" to "American Society for Quality".

Introduction

ASQ has been at the forefront of the quality movement for 75 years. Headquartered in Milwaukee, ASQ traces its beginnings to the end of World War II, as quality experts and manufacturers sought ways to sustain the many quality-improvement techniques used during wartime. ASQ has played a crucial role in upholding these standards from the past while, at the same time, championing continued innovation in the field of quality.

By the end of the 1970s, the principles of quality had greatly influenced manufacturing and other industrial processes, by focusing attention on how products and services could define and meet technical specifications. Businesses typically established a quality-control department to ensure specifications were met.

In the 1980s, ASQ members began to see how quality could be applied beyond the world of manufacturing. Quality, they realized, could make a difference in any organization and touch every person in it. Quality began to blossom into a much broader discipline aimed at leading, inspiring, and managing a broad range of businesses and activities, always with a focus on excellence.

Today, ASQ has become a global organization, with members in more than 130 countries. ASQ now has service centers in Mexico, China, and India, and has established strategic alliances with numerous organizations. ASQ empowers people, communities, and organizations across the world to achieve excellence through quality.

The ASQ Timeline

1946

The American Society for Quality Control is formed on February 16 by 253 members of 17 quality-related societies. George Edwards, director of quality assurance at Bell Telephone Labs, is elected president. *Industrial Quality Control b*ecomes ASQ's first flagship publication. The first Section outside the U.S., the Toronto Section, received its ASQ charter on December 15, 1946.

1948

ASQC's Code of Ethics establishes responsibilities and standards by which members should conduct their activities and business.

1949

First Shewhart Medal is awarded to Leslie Simon, director of the Ballistics Research Laboratory in Maryland.

1956

Headquarters operations are consolidated in Milwaukee; a full-time administrative secretary is employed to handle expanding operations. The International Chapter is formed to provide services to members abroad.

1959

ASQC and the American Statistical Association jointly create *Technometrics*, a journal covering the physical, chemical, and engineering sciences.

1960

The Education and Training Institute Board is formed with a national program focusing on management seminars and quality control engineering courses.

1968

Industrial Quality Control is replaced by two new publications, *Quality Progress* magazine and *The Journal of Quality Technology*. The first certification examinations are held for quality engineers.

1984

October is designated National Quality Month by Congress to emphasize to business leaders that quality is essential to U.S. preeminence in products and services.

1987

The Malcolm Baldrige National Quality Award is established, with ASQC as a co-administrator.

1990

The Registrar Accreditation Board is founded as an independent organization to accredit third-party ISO 9000 registrars.

1993

The Public Sector Network Technical Committee (now the Government Division) established. *Quality Management Journal* debuts.

1995

The Certified Quality Manager program is developed.

1997

ASQC drops "Control" from its name, becomes ASQ and formally adopts a new mission to promote performance excellence in a broad range of organizations and activities worldwide.

1998

ASQ is named administrator of the QuEST Forum, which develops the TL 9000 telecommunications standards. The journal *Software Quality Professional* debuts. ASQ rolls out Six Sigma black belt training for individuals and organizations. The American Customer Satisfaction Index expands to include 32 high-impact federal agencies.

2001

The Certified Quality Improvement Associate (CQIA) program is introduced. ASQ relocates to the ASQ Center, its current world headquarters, in the landmark Gimbel's building in downtown Milwaukee. ASQ's Six Sigma Forum is launched. *Six Sigma Forum Magazine* debuts. ASQ membership extends to 122 countries. International Six Sigma program is launched in Europe. Gazeta Global, an international newsletter, is founded. The Japanese Union of Scientists and Engineers (JUSE), Excellence Ireland, the Israel Society for Quality (ISQ), and Brazil's Regional Program of Quality and Productivity, Programa Gaúcho da Qualidade e Produtividade (PGQP), become WorldPartners.

2004

ASQ China is launched. ASQ leads the charge that culminates with President Bush signing into law the bill to create a nonprofit category of the Baldrige Award. ASQ's board of directors voted to change the name of Region 4 to ASQ Canada. ASQ's International Six Sigma Program expands into Latin America with Spanish-language Six Sigma courses offered through local training partners. ASQ Costa Rica becomes the first International Member Unit (equivalent to a Section) outside of North America.

2006

ASQ launches an initiative to promote the Economic Case for Quality. ASQ is named secretariat for the US TAG to the ISO Committee on Social Responsibility. ASQ successfully campaigns to have the Baldrige Award expanded to cover the nonprofit sector. ASQ forms 11 new networks and communities of practice to expand networking opportunities for individuals with a wide range of interests. ASQ hosts expert panel discussion on quality and healthcare for members of Congress.

2008

Quality Progress magazine introduces a new design and launches its own separate and fully featured Web site.

2010

World Quality Month was created to reignite attention once generated in the 1980s by National Quality Month in the U.S. and to create a united, global forum for the people and organizations

that have celebrated World Quality Days in November to come together and raise their voices for quality.

2013

ASQ releases the Global State of Quality: Discoveries Report. This groundbreaking initiative identifies quality successes and opportunities from around the world. This unprecedented worldwide research took nearly a year and a half to complete, with more than 2,000 survey responses from organizations in more than 22 countries.

2016

ASQ celebrates 70 years of serving members and the global quality community!

2019

In partnership with Boston Consulting Group and Deutsche Gesellschaft für Qualität (DGQ), ASQ released study on Quality 4.0. This research focused on the opportunities and challenges arising from Quality 4.0—the application of Industry 4.0's advanced digital technologies to enhance traditional best practices in quality management.

2020

ASQ Technical Community chairs and members contributed to "Quality's Impact on the global Pandemic Response" an introduction on the role quality played in the COVID-19 vaccination process. This piece highlights how quality principles are foundational for industries integral to each stage of the COVID-19 response (vaccine development and approval, distribution, and administration).

2021

ASQ celebrates 75 years of serving the global quality community.

Certification Programmes

ASQ offers 18 professional certifications relating to various aspects of the quality profession. Professional certification exams are translated into five languages included English, Korean, Mandarin, Portuguese, and Spanish. Exams are given nationally and, to a limited degree, worldwide several times annually. The body of knowledge for each certification is maintained through peer review every few years on a rotating schedule.

In 1968, the first ASQ certification was offered.

In 2016, ASQ's certification exam delivery method changed from paper to computer-based testing at Prometric nationwide testing facilities.

List of ASQ Certifications

Category	Abbr.	Title	Description
Management	CMQ/OE	Certified Manager of Quality/ Organizational Excellence	
Management	CSQP	Certified Supplier Quality Professional	
Foundational Quality	CQIA	Certified Quality Improvement Associate	
Foundational Quality	CQPA	Certified Quality Process Analyst	
Inspector/Technician	CCT	Certified Calibration Technician	
Inspector/Technician	CQI	Certified Quality Inspector	
Inspector/Technician	CQT	Certified Quality Technician	
Engineering	CQE	Certified Quality Engineer	
Engineering	CRE	Certified Reliability Engineer	
Engineering	CSQE	Certified Software Quality Engineer	
Six Sigma	CSSBB	Certified Six Sigma Black Belt	
Six Sigma	CSSGB	Certified Six Sigma Green Belt	
Six Sigma	CSSYB	Certified Six Sigma Yellow Belt	
Six Sigma	CMBB	Certified Master Black Belt	
Auditing	CFSQA	Certified Food Safety and Quality Auditor	
Auditing	CMDA	Certified Medical Device Auditor	
Auditing	CPGP	Certified Pharmaceutical GMP Professional	
Auditing	CQA	Certified Quality Auditor	

Visit the following Web Page for

ASQ South Asia

https://asq.org.in/

QUOTES

of

Philip B Crosby

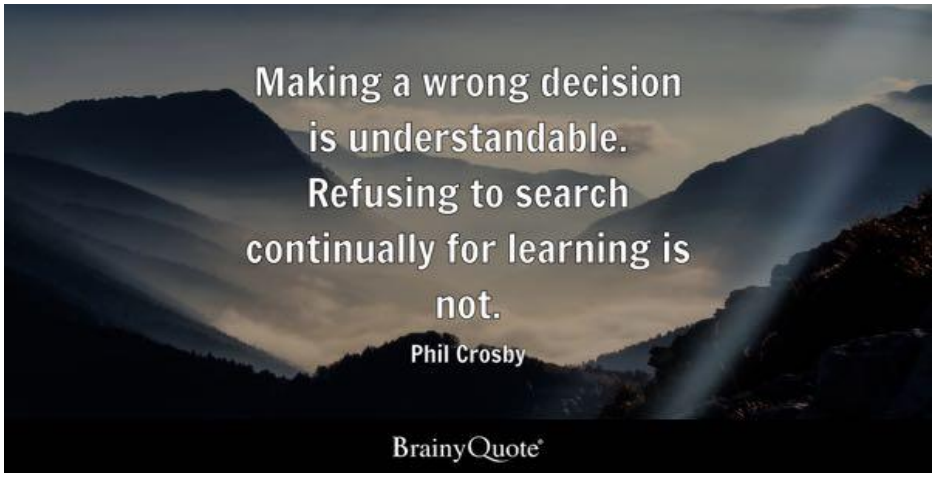
Quality is the result of a carefully constructed cultural environment. It has to be the fabric of the organization, not part of the fabric.

(😂)(😂)(😂)

Very few of the great leaders ever get through their careers without failing, sometimes dramatically.

(😂)(😂)(😂)

Quality is the result of a carefully constructed cultural environment. It has to be the fabric of the organization, not part of the fabric.

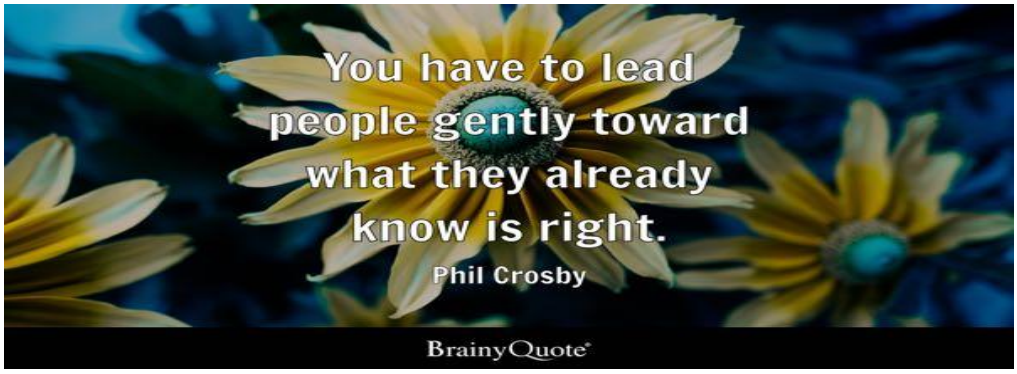


(☺)(☺)(☺)

People are conditioned to believe that error is inevitable....
However, we do not accept the same standard when it
comes to our personal life. If we did, we would resign
ourselves to being shortchanged now and
then when we cash our pay checks.
We would expect hospital nurses to drop a
certain percentage of all newborn babies.
We would expect to go
home to the wrong house periodically.
As individuals we do not
tolerate these things. Thus, we have a double standard,
one for ourselves, one for the company.

(☺)(☺)(☺)

If anything is certain, it is that change is
certain. The world we are planning for today
will not exist in this form tomorrow.



(☺)(☺)(☺)

Many managers feel, somewhat cynically, that people are being paid to do their jobs and that's that. This attitude reflects an insensitivity to people that is a trademark of many hockey-style managers.

(☺)(☺)(☺)

Very few of the great leaders ever get through their careers without failing, sometimes dramatically.

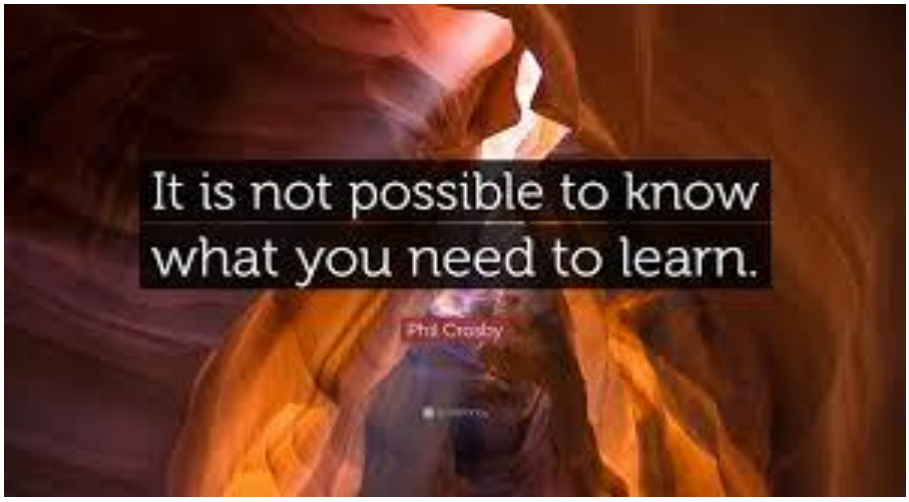
(☺)(☺)(☺)

You are going to be measured anyway by some means, fair or foul. Usually, the one doing the measuring has nothing specific in mind; so, he does it by the seat of his pants. Careers are destroyed in this manner.

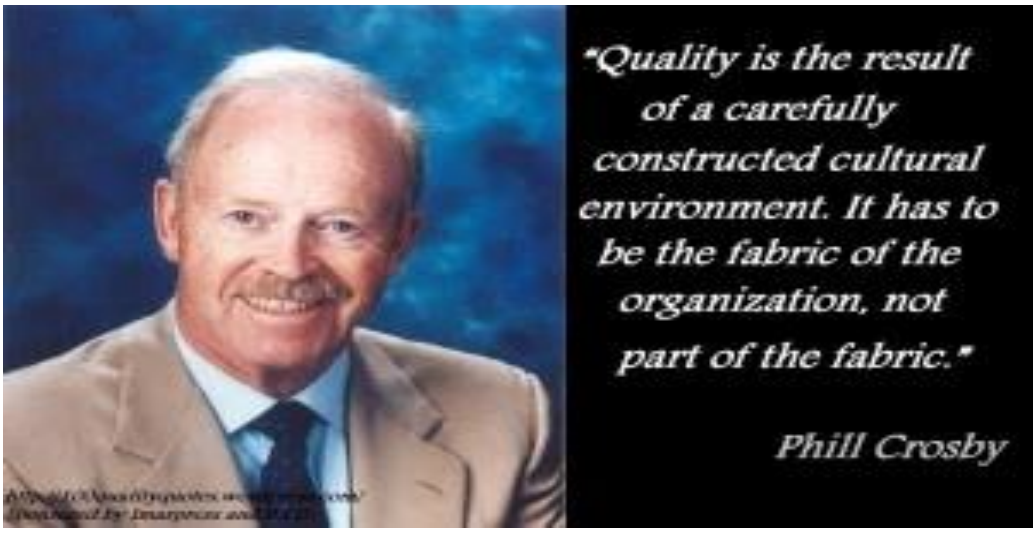
(☺)(☺)(☺)

"Quality is the result of a carefully constructed cultural environment. It has to be the fabric of the organization, not part of the fabric."

[☺][☺][☺]

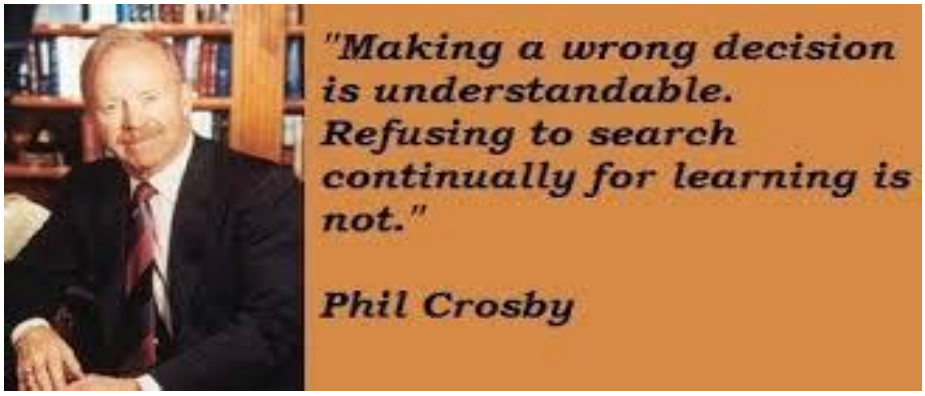


- "Slowness to change usually means fear of the new."
- "Selecting the right person for the right job is the largest part of coaching."
- "You don't have to be noisy to be effective."
- "Being convinced no one knows the whole story is the surest way to fail."
- "It is always cheaper to do the job right the first time."
- "Good things happen when planned. Bad things happen on their own."

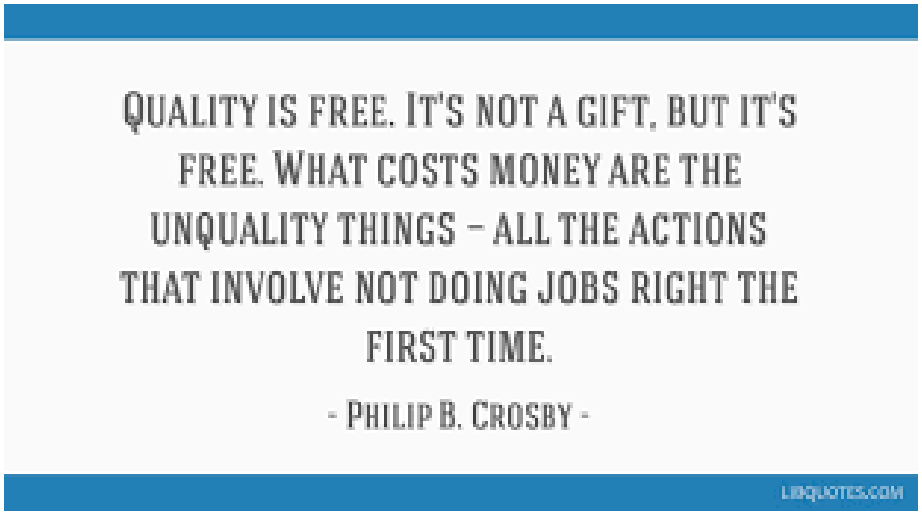

"Quality is the result of a carefully constructed cultural environment. It has to be the fabric of the organization, not part of the fabric."
Phill Crosby

The customer deserves to receive exactly
what we have
promised to produce —
a clean room, a hot cup of coffee,
a nonporous casing, a trip to
the moon on gossamer wings.

The first erroneous assumption is that quality means goodness, or luxury, or shininess or weight. The word "quality" is used to signify the relative worth of things in such phrases as "good quality," "bad quality," and that brave new statement 'quality of life.' 'Quality of life' is a cliche because each listener assumes that the speaker means exactly what he or she, the listener, means by the phrase. It is a situation in which individuals talk dreamily about something without ever bothering to define it.



Quality is free, but no one is ever going to know it
if there isn't some sort of agreed-on system of measurement. Quality has always suffered
from the lack of an
obvious method of measurement in spite
of the fact such a method was developed
by General Electric in the 1950' s
as a tool for determining the need
for corrective action on a specific product line.


QUALITY IS FREE. IT'S NOT A GIFT, BUT IT'S FREE. WHAT COSTS MONEY ARE THE UNQUALITY THINGS – ALL THE ACTIONS THAT INVOLVE NOT DOING JOBS RIGHT THE FIRST TIME.
- PHILIP B. CROSBY -
LIBQUOTES.COM

The customer deserves to receive exactly what we have promised to produce — a clean room, a hot cup of coffee, a nonporous casing, a trip to the moon on gossamer wings.

(☺)(☺)(☺)

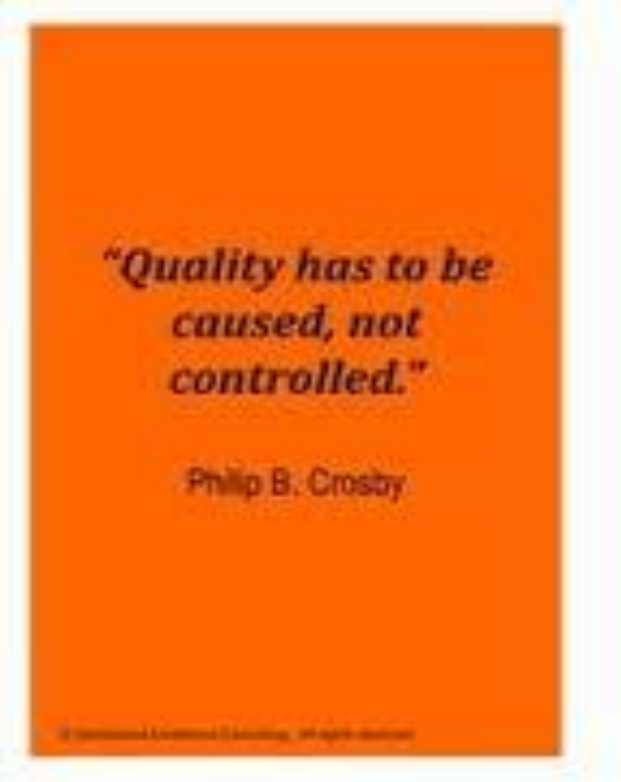
Many managers feel, somewhat cynically, that people are being paid to do their jobs and that's that. This attitude reflects an insensitivity to people that is a trademark of many hockey-style managers.

(☺)(☺)(☺)

'Quality is a result of a carefully constructed cultural environment. It has to be the fabric of the organization, not the part of fabric'
LT
1
THEIR DEFINITION OF QUALITY IS CONFORMANCE TO REQUIREMENTS, NOT GOODNESS
2
THE SYSTEM OF QUALITY IS PREVENTION
4
THE MEASUREMENT OF QUALITY IS THE PRICE OF NON-CONFORMANCE, NOT INDICES
3
THE PERFORMANCE STANDARD IS ZERO DEFECTS.

The problem of quality management is not what people don't know about it. The problem is what they think they do know.

☺☺☺



Operational Excellence Consulting

☺☺☺

Most managers are so concerned with today, and with getting our own real and imagined problems settled, that we are incapable of planning corrective or positive actions more than a week or so ahead.

Crosby

Crosby is known for his concepts of "Do it right first time" and "zero defects". He defines quality as conformance to requirements which the company itself has established for its products based directly on customer needs. He emphasizes prevention management in every area. He gave his own 14 points for quality management which were different from the 14 points of Deming.

0

Defects

(☺)(☺)(☺)

Data Quality Is Free

"Data quality is free. It's not a gift, but it's free. What costs money are the unquality things – all the actions that involve not getting data quality right the first time and all the actions to correct these data quality issues"

Philip B. Crosby (adapted by J. Schwarzenbach)

Selected Articles

on

Philip B Crosby

The following **SIX** articles on the life and works of Philip B Crosby provide the variety and depth of his excellent skills in quality.

****

01] Remembering Philip B. Crosby: A Pioneer in Quality Management
Sudip Paul, Project Manager @Google || 🎖️ 5x LinkedIn Top Voice || 300K impressions || QCFI🏆Gold Award || Lean Six Sigma Green Belt || Operational Excellence

02] Spotlight on... Philip B. Crosby
Wendy Wilson

03] I'm the guru who was wrong
Jeannette Cabanis

04] The Quality Revolutionary
Randy Noles

05] Is Crosby's "Quality Is Free" Still Useful in Modern QA?
Mike Harris

06] Advancing Zero Defect manufacturing: A state-of-the-art perspective and future research directions
Daryl Powell , Odd Myklebust, Maria Chiara Magnanini & Marcello Colledani

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Remembering Philip B. Crosby: A Pioneer in Quality Management

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Introduction:

In the realm of quality management, certain figures stand out for their profound contributions that have shaped industries worldwide. Among these luminaries, Philip B. Crosby occupies a prominent place. His insights, methodologies, and philosophies have not only revolutionized how businesses approach quality but have also become timeless principles guiding organizational excellence. As we commemorate his legacy, let's delve into the remarkable contributions of Philip B. Crosby and their enduring impact on modern business practices.

Early Life and Career:

Philip Bayard Crosby was born on June 18, 1926, in Wheeling, West Virginia. His journey into the world of quality management began during his tenure in the U.S. Navy during World War II. It was here that Crosby first encountered the significance of quality in ensuring operational efficiency and safety. Following his military service, Crosby pursued a career in quality management, holding various positions in different industries, including manufacturing and telecommunications.

Zero Defects:

Crosby's most notable contribution to the field of quality management is the concept of "Zero Defects." Emphasizing the importance of prevention over inspection, Crosby argued that defects are not acceptable under any circumstances and should be eliminated at the source. This philosophy shifted the focus from merely detecting and
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correcting errors to proactively preventing them through rigorous processes and continuous improvement initiatives. The Zero Defects approach became a cornerstone of Crosby's teachings and had a profound influence on how organizations approach quality assurance.

Quality is Free:

Another seminal concept introduced by Crosby is encapsulated in his book "Quality is Free." In this influential work, Crosby challenged the prevailing notion that achieving high-quality standards inevitably incurred significant costs. Instead, he posited that investing in quality upfront ultimately saves money by reducing rework, waste, and customer complaints. Crosby's message was clear: quality is not a cost center but a strategic asset that enhances customer satisfaction, strengthens competitiveness, and drives profitability. This paradigm shifts in thinking helped organizations recognize the economic benefits of prioritizing quality and laid the groundwork for a culture of excellence.

Four Absolutes of Quality Management:

Crosby distilled his philosophy into what he termed the "Four Absolutes of Quality Management," which serve as guiding principles for achieving operational excellence:

1. Quality is defined as conformance to requirements.
2. The system for achieving quality is prevention, not appraisal.
3. The performance standard is zero defects.
4. The measurement of quality is the price of non-conformance.

These absolutes provide a framework for organizations to establish clear quality objectives, implement preventive measures, and measure the effectiveness of their quality management systems.

Legacy and Influence:

Philip B. Crosby's contributions to quality management continue to reverberate across industries globally. His emphasis on prevention, zero defects, and the economic benefits of quality laid the groundwork for numerous quality improvement initiatives, such as Total Quality Management (TQM) and Six Sigma. Moreover, Crosby's

teachings transcended organizational boundaries, influencing diverse sectors ranging from manufacturing and healthcare to services and software development.

Conclusion:

Philip B. Crosby's enduring legacy as a pioneer in quality management is a testament to the transformative power of visionary ideas. His concepts, including Zero Defects, Quality is Free, and the Four Absolutes of Quality Management, have not only stood the test of time but continue to shape how organizations approach quality assurance and operational excellence. As we reflect on his contributions, let us uphold Crosby's commitment to uncompromising quality and continuous improvement in all facets of business and beyond.
Best regards,
Sudip Paul

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Spotlight on… Philip B. Crosby

by Wendy Wilson | Sep 20, 2022 | Quality Management
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Today we shine the spotlight on Philip B. Crosby (1926-2001), an influential author, consultant and philosopher who contributed to management theory and quality management practices. By developing practical concepts to define and communicate quality and quality improvement practices, he became an innovative and influential force in business and manufacturing. In 1979, he wrote the best-seller 'Quality is Free' and in the 1980s his company was advising 40% of the Fortune 500 companies on quality management.

Born in Wheeling, West Virginia, Philip B. Crosby served in WWII and the Korean War. He began his quality management career in quality control in manufacturing where he worked up the corporative ladder from line inspector to quality director, and subsequently he became Corporate Vice President at ITT.

PHILIP B. CROSBY IS BEST KNOWN FOR:

- Quality is Free – His first book that made him famous.
- Zero Defects – One of his four absolutes of quality.
- The Four Absolutes of Quality.
- The Fourteen Steps of Quality Improvement.
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DOING IT RIGHT FIRST TIME (DRIFT) / ZERO DEFECT(ZD)

Philip B Crosby first introduced the concept of Doing things right the first time (DRIFT)/Zero defect (ZD) in his book Quality is Free. He believed quality is free, what costs money is defects, which are all the activities resulting from not doing things right the first time. When things are done inaccurately, they have to be repeated, which results in extra costs. Likewise, when things are made incorrectly, they have to be or reworked or scrapped and produced again, costing money. It is always cheaper and efficient to do things right the first time.

THE FOURTEEN STEPS OF QUALITY IMPROVEMENT

Philip B Crosby developed 14 steps for an organisation to follow in building an effective quality programme:

Step 1: Management Commitment

Firstly, management must be committed to process improvement and this culture should be passed on to the whole company workforce.

Clarify where management stands on quality. It is necessary to consistently produce conforming products and services at the optimum price. The device to accomplish this is the use of defect prevention techniques in the operating departments:

- Engineering
- Manufacturing
- Quality Control
- Purchasing
- Sales and others.

Step 2: Quality Improvement Team

Create a quality improvement team, with representatives from all workgroups and functions. These teams run the quality improvement program. Since every function of an operation contributes to defect levels, every function must participate in the quality improvement effort. The degree of participation is best determined by the particular situation that exists. However, everyone has the opportunity to improve.

Step 3: Quality Measurement

Before you start implementing any action plan, you need to measure and assess process quality and identify the areas that need improvement.

Communicate current and potential nonconformance problems in a manner that permits objective evaluation and corrective action. Basic quality measurement data is obtained from the inspection and test reports, which are broken down by operating areas of the plant. By comparing the rejection data with the input data, it is possible to know the rejection rates. Since most companies have such systems, it is not necessary to go into them in detail. It should be mentioned that unless this data is reported properly, it is useless. After all, their only purpose is to warn management of serious situations. They should be used to identify specific problems needing corrective action, and the quality department should report them.

Step 4: Cost of Quality Evaluation

You need to assess the cost that comes along. What is the cost of quality and how does it fall into your company's overall plan? Calculate the cost of (poor) quality: Define the ingredients of the Cost of Quality (COQ) and explain its use as a management tool.

Step 5: Quality Awareness

Here, it is important to spread the importance of quality throughout your entire workforce and embrace it within your business culture.

Provide a method of raising the personal concern felt by all personnel in the company toward the conformance of the product or service and the quality reputation of the company. By the time a company is ready for the quality awareness step, they should have a good idea of the types and expense of the problems being faced. The quality measurement and COQ steps will have revealed them.

Step 6: Corrective Action

Once you have identified what needs to be improved, you will need to start implementing a plan so that corrective actions begin to roll out.
Provide a systematic method of permanently resolving the problems that are identified through previous action steps. Problems that are identified during the acceptance operation or by some other means must be documented and then resolved formally.

Step 7: Plan for Zero Defects Program

It is essential to eliminate defects. This step not only aims to reduce defects but to entirely eliminate them.

Monitor progress of quality improvement and establish a zero defects committee. Examine the various activities that must be conducted in preparation for formally launching the Zero Defects program – The quality improvement task team should list all the individual action steps that build up to Zero Defects day in order to make the most meaningful presentation of the concept and action plan to personnel of the company. These steps, placed on a schedule and assigned to members of the team for execution, will provide a clean energy flow into an organisation wide Zero Defects commitment.

Since it is a natural step, it is not difficult, but because of the significance of it, management must make sure it is conducted properly.

Step 8: Supervisor Training

To achieve process quality, you must have supervisors which actively embrace this culture. To enable them to do this, you need to provide them with the right training. Define the type of training supervisors need in order to actively carry out their part of the quality improvement program. The supervisor, from the board chairman down, is the key to achieving improvement goals. The supervisor gives the individual employees their attitudes and work standards, whether in engineering, sales, computer programming, or wherever. Therefore, the supervisor must be given primary consideration when laying out the program. The departmental representatives on the task team will be able to communicate much of the planning and concepts to the supervisors, but individual classes are essential to make sure that they properly understand and can implement the program.

Step 9: Zero Defects Day

Further you need to increase awareness by holding a zero defects day in which are employees are taking part.

Create an event that will let all employees realize through personal experience, that there has been a change. Zero Defects is a revelation to all involved that they are embarking on a new way of corporate life. Working under this discipline requires personal commitments and understanding. Therefore, it is necessary that all members of the company participate in an experience that will make them aware of this change.

Step 10: Goal Setting

Setting goals for improvement should involve employees from the whole organization. By engaging everyone you are making sure that goals are made out clear to all levels of the organisational structure.

Encourage employees to create their own quality improvement goals and turn pledges and commitments into action by encouraging individuals to establish improvement goals for themselves and their groups. About a week after Zero Defects Day, individual supervisors should ask their people what kind of goals they should set for themselves. Try to get two goals from each area. These goals should be specific and measurable.

Step 11: Error Cause Removal

In every quality improvement effort, it is important to take a step back and identify any errors that are hindering this process. Engaging all employees in this procedure is vital.

Encourage employee communication with management about obstacles to quality (Error-Cause Removal). Give the individual employee a method of communicating to management the situations that make it difficult for the employee to fulfil the pledge to improve. One of the most difficult problems employees face is their inability to communicate problems to management. Sometimes they just put up with problems because they do not consider them important enough to bother the supervisor. Sometimes supervisors don't listen anyway. Suggestion programs are some help, but in a suggestion program the worker is required to know the problem and also propose a solution.

Error-cause removal (ECR) is set up on the basis that the worker need only recognize the problem. When the worker has stated the problem, the proper department in the plant can look into it. Studies of ECR programs show that over 90% of the items submitted are acted upon, and fully 75% can be handled at the first level of supervision. The number of ECRs that save money is extremely high, since the worker generates savings every time the job is done better or quicker.

Step 12: Recognition

Recognizing employees that excel in the quality improvement efforts and celebrating their success will not only encourage them to continue the good work, but it will also inspire others to start taking part.

People really don't work for money. They go to work for it, but once the salary has been established, their concern is appreciation. Recognize their contribution publicly and noisily, but don't demean them by applying a price tag to everything.

Step 13: Quality Council

Bring along specialists and hold quality councils on a regular basis in order to create focused and clearly defined goals.

Bring together the professional quality people for planned communication on a regular basis. It is vital for the professional quality people of an organisation to meet regularly just to share their problems, feelings, and experiences, with each other. Primarily concerned with measurement and reporting, isolated even in the midst of many fellow workers, it is easy for them to become influenced by the urgency of activity in their work areas. Consistency of attitude and purpose is the essential personal characteristic of one who evaluates another's work. This is not only because of the importance of the work itself but because those who submit work unconsciously draw a great deal of their performance standard from the professional evaluator.

Step 14: Do It Over Again

Quality improvement does not end. Crosby's model is not an ad-hoc model but rather a process of continual process. So, make sure that you repeat this process over and over again.
Emphasize that the quality improvement program never ends. There is always a great sign of relief when goals are reached. If care is not taken, the entire program will end at that moment. It is necessary to construct a new quality improvement team, and to let them begin again and create their own communications

CROSBY'S FOUR ABSOLUTES OF QUALITY MANAGEMENT

Philip B Crosby is known for the concepts of "Quality is Free" and "Zero Defects", and his quality improvement process is based on his four absolutes of quality.
From his Fourteen Steps Of Quality Improvement, Crosby, believed management should take prime responsibility for quality, and workers only follow their managers' example. Crosby defined the Four Absolutes of Quality Management:

1. The First Absolute – The definition of quality is conformance to requirements (not as goodness)
2. The Second Absolute – The system of quality is prevention (not appraisal)
3. The Third Absolute – The performance standard is zero defects (not "that's close enough").
4. The Fourth Absolute – The measurement of quality is the price of nonconformance (not indexes).

CROSBY'S FIVE CHARACTERISTICS OF A HIGHLY SUCCESSFUL ORGANISATION

According to Crosby, five characteristics of a highly successful organisations are:

1. People routinely do things right first time
2. Change is anticipated and used to advantage
3. Growth is consistent and profitable
4. New products and services appear when needed
5. Everyone is happy to work there.

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Crosby has an opinion about that … in fact, this affable, plain-spoken quality revolutionary has an opinion about almost everything. Here is a sampling:

On the quality movement …

We hear a lot of talk about quality, yet every time you buy something or have a service performed, it's disappointing. Are we getting better or worse?

It's better than it used to be because operating management is aware that we have to take quality into consideration. Particularly in the design of new products, we have gotten a lot better.

The main obstacle to quality is the quality professionals. They argue with each other about these little programs and they write books that repeat conventional wisdom and useless statistics. They don't ever bother to understand what I've said in this book (Quality Is Still Free, McGraw-Hill, 1996), that business is transactions and relationships. All we have to figure out is what transaction we are supposed to do and then get it done right. And meantime, let's help our suppliers and employees and customers be successful. That's all you've got to do; that's the whole mission of quality. But they get wrapped up in these little things—like the stupid Baldrige Award. People are finally realizing that adhering to that stuff doesn't get you anywhere. You may win the award but it doesn't get you any respect because it's a self-nomination. That's why every year fewer people apply for the thing. Think about it: 50 applications, maybe, out of seven million companies in the country.

Forty years of butting heads with conventional ideas about quality and leadership hasn't dulled Philip Crosby's enthusiasm for the fight.

They took my nice little idea of quality management and turned it into a junkyard. Quality management is concepts, TQM is procedures. Everyone likes procedures because then you can go around and measure procedures; it doesn't make any difference whether you get any work done or not … but if you want to deal in concepts, then you have to go to the heart of the matter and ask the hard questions. Concepts are truths that apply to all situations. But we're procedure-oriented in a world of concepts.

In management textbooks, your name isn't usually included on the list of quality gurus. Why is that, do you think?

Actually, I am on the list, except I'm the guru who was wrong!

No, academics don't like my books because they don't have any graphs in them. The people who follow my thoughts are managers, people who actually have to produce something. They need to know: What can I do so that everything that goes out the door, whether it's in an envelope or in a box or in the form of a human activity, is exactly what it was supposed to be—exactly.

Don't Believe in Zero Defects?

Crosby's quality standard of nothing less than perfection may receive a lot of negative press in the quality-theory world. But in the real world, it may be more prevalent than you think. Consider these facts, published in Industry Week (Feb. 3, 1997).

Even being 99.9 percent right leaves a huge margin for error. If 99.9 percent right were good enough:

- Banks would deduct 22,000 checks from the wrong accounts each hour.
- Pharmacists would process 20,000 incorrect prescriptions each year.
- Phone companies would misplace 1,314 phone calls each minute.
- Printers would produce 2,488,200 magazines with the wrong covers each year.
- Airline pilots would make 730 unsafe landings at O'Hare International Airport each year.
- Hospitals would give 12 babies to the wrong parents every day.

Maybe because of your style of writing and speaking, you've been called the "salesman of quality." What do you think of that title?

That's not a bad thing to be. The thing about me is that people can understand me. Unlike some of these folks, I talk about real things. My four absolutes of quality—conformance to requirements, prevention, a performance standard of zero defects, and measuring success by the price of nonconformance—any numbskull can understand them. The reason Quality is Free was such a big hit was that it took this subject of quality, which had been made into gibberish, and put it in English. See, I didn't understand it myself, I was in it for years and I never could figure out what the heck—finally I figured it out and then I just separated myself from all the quality stuff and ran ITT. I ran the quality system worldwide in ITT, and we did fine. All over the whole company, everything got better. More profitable. When I wrote the book, I just explained how to do that to executives.

See, the secret to the whole thing is attitude. If you believe that there's no such thing as a blue car, and someone shows you a blue car, you have to assume that that's not a blue car, because you don't believe in it. Conventional wisdom says it doesn't exist.

Now, when you talk to statistical people, there's no zero in statistics, so they start off with the fundamental belief that a certain amount of products have to be bad, that you can never reach zero defects. That thinking sets the standard. Then management says, "Cars that have no defects would bankrupt us because we'd have so much inspection and rework and so on." Well, I came along and said, "No, just learn how to make the damn things right." That was such a culture shock, that it got people's attention. And the fact that I am an entertaining speaker is why people thought I was a salesman. But everybody is a salesman. If you don't sell your ideas, who is going to do it?

You have some strong opinions about relating quality to customer satisfaction.

The idea of having requirements be customer-defined is silly. Think about the reality of it. How do you get that out of the customer? You pass off your responsibility to some mysterious group of people called the customers, who don't always know what they want. One of the famous surveys done by electronics companies in the U.S. asked, "If we gave you a machine that you could put a piece of paper in and a copy of the document would appear at somebody's desk on the other end, would you use that?" The result was "No, who wants that?" The Japanese just went ahead and built faxes. Now everyone has a fax. Who could live without a fax? But there aren't many American-made ones. There's a case where they asked the customer what they wanted and the customer didn't understand the business. Also, customers change their minds; they aren't loyal. So when people say the customer sets the requirements, I want to see those requirements, see how they were derived.

And having customer satisfaction as the goal is self-defeating, because your most dissatisfied customers always vaporize. You're asking the choir how they like the church.

So, you feel the quality movement has gotten sidetracked?

Well, yes. See, when I started Phil Crosby Associates in '79, everyone was desperate. None of the quality stuff worked. Then companies like Milliken called their suppliers and said, "Go to [PCA's] Quality School, give us stuff we can work with." When things started to get better, management stepped back and said, "OK, now we can turn this over to the quality professionals again, and they went back to acceptable quality levels and Six Sigma. As a result, now you get cars that are almost defect-free—but not really.

Now, I don't disagree with continuous improvement … I think that's a good lifetime goal. But that isn't what most people think CI means. They think it means that if we dropped eight babies this week, we'll only drop seven babies next week and six the week after that and then we'll apply for the Baldrige because our percentages will look good. It's a way of getting around zero defects.

On the myth of team synergy …

In your book you seem to be down on teams. Isn't that inconsistent with your emphasis on good relationships at work?

Have you ever been to a team meeting? How many people talk? I don't know of any team that ever solved a problem; usually the real problems are so political in nature that everybody's afraid to mention them during the meeting.

What's the answer to that?

You have to let people take action individually. The more organized you get, the more political you get, the less happens. Here's an example: When I first went to ITT they sent me down to Puerto Rico to look at a telephone manufacturing plant we had down there. I'm not a telephone expert, but I could see that they were making something nobody wanted. There was no market for it. But there was an executive vice president up in New York that thought this was a great idea. So I went home and wrote a memo that said maybe we ought to forget about this thing and make something somebody is going to buy. The next thing I know, the VP storms into my office—I didn't know who the hell he was—and I said, "Well, I'm sorry. I didn't mean to hurt your feelings, but the thing is useless, they [in Puerto Rico] all think it's useless." But nobody down there would ever have spoken up against it.

You see, you need people who have no strings and who can tell it like it is. That's what the quality business really started out to be. The idea was, we would have these people over here who were knowledgeable and could measure stuff and they would tell you when the process was getting out of control, and people would listen to them.

Harold Geneen of ITT says synergy is bogus. I take it you don't believe in it either?

If you take a group and give it a project like "How could we improve the service in this restaurant?" they can do that. But if you talk about a totally new concept for a restaurant, no. Innovative ideas come from the individual. You don't get many innovative ideas out of a committee, unless you have an innovative individual on the team who's planting the ideas.

If you look at the team, you'll find one or two people in there that are the thought leaders. Teams have their value but if you go back and look at all the great advances in history it's always an individual that has come up with that. There are a lot of signatures on it, but Thomas Jefferson wrote the Declaration of Independence.

Now, there are a lot of great ideas that individual minds come up with but they may not be able to make anything of it. So, you need somebody who is an innovator and an implementor. That's a pretty tough combination. Somebody who gets the ideas and then actually goes and does something about it.

When you talk about the people who get things done—who get the right things done—there's a very small percentage of them who actually do something. There are people that if they never came back to work it wouldn't make any difference. About half of them. That's not cynical, that's just right. You ask somebody to do something, and then you've got to remind them. People are preparing, they're getting ready to do things, they plan, it takes forever and ever and ever.

Years ago, I was on a corrective action team and nothing ever got done, so after a couple of meetings, I started messing around and fixing things. I just found out who was responsible for it, found out what the problem was, asked them to do something, get it done; pretty soon all the problems were off the list. And I got hell from my boss. I "went around the system." There are no systems! People write about systems, but in reality, there are only individual people getting things done. You just have to find that person who will get things done and get out of the road.

On project management …

Project management is like quality management, it's both more and less than it's cracked up to be … Doing it by the project management method, this thing came in on time, under budget and it worked. That's the whole idea. But then you start to get complicated and professional and, really, you don't have to be a professional to do it. The professionals in almost every profession screw the thing up.

For example, at Martin Marietta we had a whole room devoted to PERT charts that were supposed to tell us what to do, how to make decisions, etc. Problem was, the room was always locked. We had a problem one day and went down there to look at the charts and couldn't get in, couldn't find the guy who had clearance to get in. So there we were, the planning guy and the manufacturing guy and the engineering guy were all standing there in the hall and we all talked about this big problem. So I said, "OK, you can do this and I'll do that," and we chatted for a minute and we went off and solved the problem. Later I walked past the PERT room and it was still all locked up! What good does that thing do? I asked myself. None of these managers would

ever think of going to that system for help. See, it's like I said: The real work happens outside the system—the system is just entertainment.

On leadership …

Tell us about your new book (The Absolutes of Leadership, Pfeiffer, 1996).

I was giving a talk to a group of senior managers and someone asked me, "What does an executive or manager need to have to be ready for the 21st century?" And, on the spot, it came to me that they needed four things:

■ An agenda (organizational and personal).

■ A personal philosophy of management. Not the latest book or fad (what Dilbert calls "the dead woodchuck under the porch"), but something you've thought about. It should include a philosophy of finance. Mine is that finance is nourishment, not a control mechanism, it's what you feed the company with. And a personal philosophy of quality; mine is based on prevention. You don't just believe whatever the quality people tell you, like "Here's the quality thing of the year, ISO 9000. Boy, we'll get signed up with this and we'll be set!" Anybody who believes that deserves whatever happens to them. Then you have to have a personal philosophy on relationships. Mine is to help employees, suppliers and customers be successful.

■ Then you have to build enduring relationships. Let me give you an example: I treat everybody the same. That's just how I am. I talk to the doorman like I talk to the chairman like I talk to anybody. They had this surprise party for my 70th birthday and 300 people showed up, most of them ex-employees whom I can do nothing for, but we have enduring relationships.

■ Finally, you have to be worldly. Be comfortable dealing with any kind of people in any situation. It's a true world economy, but most people still don't think in those terms. I talked to a bunch of college presidents in Orlando a few weeks ago, and I thought, well, I might as well give them their money's worth, so I told them that the education industry in 1996 reminds me of the auto industry of 1966. They are convinced that they know all the answers, they know how to do it, that this is the only place that you can come get an education …

But if you think about what you can do electronically, there's no reason people have to come sit in a classroom to get an education. If you look at Asia, there are 3 billion people, half of them under 25 years old. What a market!

Being worldly means you expose yourself to different people, different cultures. I have gone out to talk to many companies where there would be 40 fat, white, gray-haired men in the audience. Those guys are going out of business, because when you all look the same way, all think the same way, you all get the same golf handicaps and went to the same schools, you don't know what's going on in the world.

Those four items I call the absolutes of leadership. For the rest, they have to buy the book.

On projecting the world …

The thing that big companies have a hard time doing is recognizing talent. I think that maybe you just can't have big companies anymore.

What will replace them?

Little companies. When you get over 200 people, you can't really manage anymore. When I left PCA, it was 320 people all over the world. I stopped knowing everybody after 200. It got too big.

I think the idea is good of setting up business unit organizations, which are basically projects. If you carve out business units, you could run each one like a project, recognizing that it's never going to go away, but that you have to have a continual influx of new ideas and products, and you can't ever get yourself locked into a mode of operation.

On the dumb things companies do …

IBM, Xerox, GM: they all got into trouble in the '70s because they thought they were the market. That was a tough lesson. The funny part of it is, it was very apparent. Back in 1968 I talked to the automotive people and predicted the future for them—you know, that they were going to lose market share to the foreigners, that customers were going to revolt because they made crappy cars, that they treated their dealers bad—and they didn't boo and hiss, but they were very glad to get rid of me. But all those things happened!

How do you explain this resistance to simple truths that seems to keep tripping us up?

Barbara Tuchman wrote a book, The March of Folly, about this very thing. Her definition of folly was that it had to be obvious that this was the wrong way of doing it, that there had to be many other ways of doing it, and that the solutions were not that hard, but they deliberately chose a tack that was contrary.

I suppose it's human nature: People believe a lot of things that are based on totally erroneous ideas. Like, there's no such thing as a blue car.

All I can say is, the Quality Management Foundation in India is putting all my ideas on CD-ROM … maybe someday, after I'm dead, somebody will look it up and decide that I was right, after all! ■

Jeannette Cabanis is a news editor and staff writer for PM Network. She interviewed Phil Crosby in July 1996 at his home in Highlands, N.C. Mr. Crosby can be reached at PhilCros@aol.com.

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The Quality Revolutionary

By Randy Noles

https://winterparkmag.com/2018/10/04/the-quality-revolutionary/

From his home base in Winter Park, Philip B. Crosby impacted businesses all over the world. Each week, hundreds of corporate bigwigs traveled here to learn about his approach to quality improvement, which he described in 1979's Quality is Free.

When Winter Park Publishing Company LLC moved its offices last year, we found ourselves occupying a building in which I had worked 35 years before — for perhaps the most interesting and impactful small business that ever hung out a shingle in this town.

If memory serves, although the interior of 201 West Canton Avenue has been reconfigured, I'm now sitting in the former office of my erstwhile boss — a man whom I count as a personal hero, and whose philosophy has for decades guided how I approach work.

The business was Philip Crosby Associates (PCA). In the company's heyday, when major American manufacturers were fighting to overcome the perception — the reality, in fact — that their products were inferior to those made overseas, it was Crosby, an internationally known business philosopher, whose guidance was sought by beleaguered executives.
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Each week, hundreds of corporate bigwigs from around the country — and around the world — traveled to Winter Park to attend Crosby's "Quality College" for five days of lectures from and discussions with the man who had written the 1979 business bestseller *Quality is Free* and had invented the concept of "zero defects" in manufacturing.

Crosby was entertaining and inspirational — although he despised comparisons to motivational speakers. One trade publication described him as "the fun uncle of the quality revolution," which was a clever if incomplete descriptor. This fun uncle had been worldwide vice president for quality at ITT.

As PCA grew, and bright young acolytes were trained to teach his concepts, Crosby began holding impromptu confabs with Quality College attendees, for whom he was something of a rock star. "Quality can't be controlled," Crosby would proclaim. "It has to be caused, starting at the top."

This was important stuff for American industry. But it was also important for Winter Park. First, it showcased the city to countless influencers, many of whom undoubtedly returned for more leisurely visits with their families.

Every day, Quality College attendees lunched en masse at Park Avenue restaurants. Rooms at the Mount Vernon Inn were booked solid for months in advance. Crosby — who looked like Teddy Roosevelt in a power suit — lavished patronage on hundreds of local vendors, all of whom were proud to be selected by a company synonymous with the best of everything.

Of course, the word "quality" meant something different to Crosby than it did to most of us. To him, quality meant simply conformance to requirements — whatever those requirements might be. A Chevette that met all the requirements of a Chevette was every bit as much a quality car as a Cadillac that met all the requirements of a Cadillac.

Further, he preached, it was always cheaper to "do it right the first time" than to assume, as most American companies did, that errors would invariably occur. The expense of implementing a zero-defects policy would always be recouped, he contended, by eliminating waste and do-overs.

PCA eventually came to employ some 300 people, all of them well paid and even pampered. Top executives drove company Cadillacs (General Motors was a major client) and everyone from the custodian to the COO believed that they were performing both a job and a patriotic service.

But, when I joined, PCA hadn't yet reached those heights. I had written a story about Crosby for a local newspaper, and he seemed impressed that I appeared to understand

his message. Would I be interested in coming to work for him and starting a company newspaper?

Not a newsletter, he emphasized. A real weekly newspaper, like a small city would have, with stories about the company and its people. I thought about it — for about 10 seconds. A few weeks later, I was editor of *This Week at PCA* — a tabloid with an initial press run of about 45 copies. The boss even gave me a nickname: "Scoop."

PCA had a remarkable run, surviving economic downturns and flavor-of-the-month management trends. But it couldn't survive Alexander Proudfoot PLC, a U.K.-based consultancy that bought the company in 1989 and ran it into the ground.

Crosby rescued the company's remnants in 1997. But he died at age 75 in 2001, before he could complete his reclamation project.

There's still a Philip Crosby Associates in Boston, but the latest iteration seemingly has no website and several calls succeeded only in reaching an automated voicemail service.

I like to think Phil would enjoy *Winter Park Magazine*. I expect he would appreciate the fact we strive (not always successfully) to eliminate defects and do it right the first time.

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Is Crosby's "Quality Is Free" Still Useful in Modern QA?

https://thectoclub.com/quality-engineering-planning-strategy/quality-is-free/

Crosby's Quality is Free argues that the cost of poor quality outweighs the cost of programmes to improve quality. Which of his ideas are still relevant today?
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Author:

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It is useful to review the practices of quality professionals from earlier eras to see what we can learn and what it tells us about how we work. I led a workshop for The QA Lead on the ideas of W. Edwards Deming in 2021, and below I will review the work of Philip B. Crosby.

Crosby was Director of Quality at ITT and he argued that quality is free because the costs of improving quality will be more than met by reducing the Cost of Quality. Crosby also created a program to improve quality called "Zero Defects", the cost of which would be more than covered by the costs of poor quality. He is also known for his book Quality is Free, in which he explained these ideas.

The Cost of Quality

In defining The Cost Quality, Crosby shows how much poor quality costs businesses and so shows how programmes to improve quality can save the company money and increase profits. He says that the Cost of Quality is made up of a number of ingredients. He was writing about manufacturing and included the following ingredients: scrap, rework, service, engineering changes, purchase order changes in the Cost of Quality. The ingredients he lists easily relate to items that software engineers deal with today:

- Scrap is rather like unfinished work
- Rework, this is like fixing bugs
- Service, this is customer service time
- Engineering change, is similar to refactoring
- Purchase order changes, is like customer churn

And an ingredient representing fixing incidents in production could be added to the list of ingredients of the Cost of Quality. The Cost of Quality really represents the cost of poor quality.

That it is so easy to relate to the ingredients that Crosby wrote about in the 1970's shows how powerful the concept of the Cost of Quality is. If a company can improve its quality, it can reduce the costs of the ingredients and so reduce its costs. There is also a cost of each of the ingredients in terms of time as well as money. Improving quality will also save time, for example reducing the amount of time spent on bug fixing will save development time.

Today we would be more likely to express the Cost of Quality in time more than in money, as fixing bugs uses up development time that could be spent creating new features. The Cost of Quality shows the cost of poor quality, which makes it possible to argue that "Quality is Free".

Crosby's Quality Improvement Programme

Crosby had a 14-point quality improvement programme called "Zero Defects". It is useful to consider how the points in the programme can help an engineering team today.

Point 1: Management Commitment

Crosby says that this point is "To make clear where management stands on quality". He stresses the importance of management having a commitment to quality and that this should be expressed by writing a formal quality policy.

Managers easily express support for quality but committing to quality is more demanding as it should include them understanding the processes to improve quality. It would be more useful if this commitment was expressed in developing their understanding of quality, for example by studying quality.

If management does not have this understanding, they may fail to help the company to improve quality as problems occur. Everyone at the company will be influenced by the level of commitment that management has.

Crosby wrote, "Workers are like a mirror. The reflection you see is your own". Management commitment is also important for success because problems will be encountered and if managers understand how to improve the quality they will be able to support their teams in improving quality.

Point 2: Quality Improvement Team

A Quality Improvement Team should be recruited "to run the quality improvement programme". Crosby says that this should be a part-time role except for the chairperson.

In manufacturing this may have been a good way to organise for quality, however lean and agile development teams have a flatter structure. Having a separate quality improvement team places quality outside the normal line of management which could lead to it not having as much weight as day to day issues. It also takes responsibilities for quality improvement away from the engineering teams. Quality improvement, for lean and agile teams, is more likely to succeed if it is at the heart of what the team does and so should be part of the team's responsibilities.

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Point 3: Quality Measurement

Quality measurement is needed "to provide a display of current and potential non conformance problems in a manner that permits objective evaluation and corrective action".

A team needs to know where it is in relation to quality and quality measurement can help a team in that regard. If the metrics are imposed on a team or used to criticize rather than support the team metrics can cause discontent. It is important that metrics are seen by the team as being supportive of their goals as if they feel that they are being judged a team can become defensive.

Point 4: The Cost of Quality

It is useful to evaluate the cost of quality as this will define the ingredients of the cost of quality for the teams that you are working with. Every company is in a different situation and it will be useful to evaluate its cost of quality. You may find that this company has a lot of unfinished work or that it spends a lot of time fixing

bugs. The costs of quality that are identified are those that the company can work to reduce.

Knowing their cost of quality will also help motivate the team as the concept of The Cost of Quality then will become a practical thing for them to change for the better.

Point 5: Quality Awareness

Crosby advocates meetings between management and staff and a publicity campaign as a "method of raising the personal concern felt by all personnel in the company toward the conformance of the product or service and the quality of the product or service and the quality reputation of the company."

This method of raising quality awareness is to show that quality is important to the company but it separates quality from other activities. It would be more useful to discuss quality in the context of work that is in progress so that quality can be built-in or to consider what can be learnt about quality when something has failed.

Point 6: Corrective Action

Corrective action is "to provide a systematic method of resolving forever the problems that are identified through previous action steps." Crosby advocates regular meetings between managers to resolve problems that have been detected.

Software engineers are motivated professionals and, instead of managers considering unresolved problems, it would be more effective to re-interpret this point to empower engineering teams to learn from defects and take corrective action that creates solutions to the issues.

Point 7: Zero Defects Planning

Crosby says that you should examine the various activities that must be conducted in preparation for formally launching the zero-defects programme. Any initiative to improve quality will need planning. According to point 7, the planning needs to cover explaining the concept of the programme and take into account the "cultural environment of your particular organisation".

Point 8: Supervisor Training

This is "to define the type of training that supervisors need in order to actively carry out their part of the quality improvement programme". A supervisor would have been the first line in management, would have supervised the work of staff and reported to a manager. We may no longer have staff with the title of supervisor but people

with leadership roles such as scrum masters, product owners, and test leads will probably need training in order to better support a quality initiative. This point is to provide for training for supervisors but not for management or team members. Quality is management's responsibility and management needs training too.

In a lean or agile team, all staff would benefit from training as they all contribute to quality. Training needs to be lifelong learning as we always have things to learn and creating a culture of lifelong learning will raise the abilities and knowledge of all employees. Continuously developing skills and knowledge is an activity that all staff need to embrace as developing themselves enables us to help our teams improve quality.

Point 9: ZD Day

A Zero Defects program starts with an "event that will let all employees realise through a personal experience that there has been a change". The example in the book "Quality is Free" includes every employee signing a pledge "to do my job right the first time" and being given an "I'm for quality" badge. This places responsibility on the employees without giving them agency and so is not going to create a positive reaction that improves quality.

Point 10: Goal Setting

Goal setting is to turn pledges and commitments into action by encouraging individuals to establish improvement goals for themselves and their groups. A better way to ask teams to improve quality would be to help teams to improve continually as setting a goal means that once the goal has been reached the team has succeeded and does not need to improve further.

Creating a culture of continual improvement would be a better way to achieve improvements in quality than setting goals...

Point 11: Error-Cause Removal

This is "to give the individual employee a method of communicating to management the situations that make it difficult for the employee to meet the pledge to improve". This empowers staff to raise issues in order to improve quality and Crosby states that every error that cause removal action should be praised.

In an agile or lean software development team, error-cause removal could be even more powerful as staff should be able to take many actions to remove causes of errors without needing the prior approval of a manager.

Employees experience the quality of the product during their work and will have suggestions as to how to improve quality. Error-cause removal would be powerful if staff were empowered to take action themselves to improve quality without the need to ask management.

Point 12: Recognition

Recognition of those who participate in the program, whether it be by public praise or by an award, is really powerful. Crosby points out that people don't really work for money, there are other factors that we value such as appreciation. It is possible to engage people in a programme to improve quality by giving recognition for their contribution, this can help create a culture of quality which is so important in improving quality.

Point 13: Quality Councils

Crosby says that there should be a Quality Council that aims to bring together the professional quality people for planned communication on a regular basis. If there are a number of testers working in a company, it is useful to bring them together in a Community of Practice to share ideas and problems. Testers can support and learn from each other if they meet regularly.

Point 14: Do It All Over Again

Quality improvement is a continuous activity and Crosby says that you should "do it all over again" in order "to emphasise that the quality programme never ends". Crosby talks about changing the manager who leads the plan for the second year. This may have been the correct approach in manufacturing but in a lean or agile development team, the team should own the quality of their work and therefore own the plan.

This step turns the programme into a cycle. The programme would also benefit from creating learning cycles from error cause removal and corrective action so that each time an error cause has been removed the knowledge gained is shared across the teams so it can be used in planning in the future to improve quality.

Conclusions

Crosby's ideas are a case of the glass being half full. The concept of the Cost of Quality is a useful tool to quantify the cost of poor quality. Identifying the Cost of Quality provides a way of arguing that "quality is free" and can help persuade people in a company to support quality improvement.

His 14-point programme, however, is not so useful today. Many of the points in the programme need updating to work for lean and agile teams and do not give teams agency to improve quality. The most useful point is the creation of Quality Councils to bring together quality professionals. The quality improvement programme would also benefit greatly from there being psychological safety in the company as this will enable employees to ask questions and raise issues without fear of repercussions. Management should strive to ensure employees feel safe psychologically at work. This is not one of Crosby's 14 points.

When I led a workshop about the work of W. Edwards Deming, I found that all his ideas are useful today, whereas Crosby should be remembered for his argument that Quality is Free, not his programme.

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Advancing Zero Defect manufacturing: A state-of-the-art perspective and future research directions

https://www.sciencedirect.com/science/article/pii/S0166361521002037

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Highlights

- •
  ZDM shows great signs of promise towards more sustainable production.
- •
  ZDM strategies aim at both defect prevention and defect compensation.
- •
  ZDM research must advance beyond discrete production processes to zero waste value chain strategies.
- •
  ZDM research must also help organizations to overcome the global application challenges of implementing ZDM.

Abstract

Zero Defect Manufacturing is a disruptive concept that has the potential to entirely reshape the manufacturing ideology. Building on the same quality management philosophy that underpins both lean production and Six Sigma, the Zero Defect Manufacturing paradigm has in recent years developed significantly, given the onset of Industry 4.0 and the increasing maturity of its digital technologies. In this paper, we review contemporary advances in Zero Defect Manufacturing using structured literature review. We explore emergent themes and present important directions for future development in this continuously emerging field of research and practice. We highlight two specific Zero Defect Manufacturing strategy types: defect prevention, and defect compensation; as well as identify two important themes for future ZDM research, namely advancing ZDM research (particularly with a view to progressing from zero-defect

processes to zero-waste value chain strategies) and overcoming the global application challenges of ZDM (with emphasis on cyber-security and the extension of defect prevention and compensation strategies to less explored manufacturing processes).

Keywords

Zero defect manufacturing, Quality management, Digitalization, Industry 4.0, Sustainability

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1. Introduction

An increasing emphasis on sustainable production requires that manufacturing companies continuously deliver higher quality products of increasing complexity at lower cost, while simultaneously limiting the use (and particularly waste) of resources within entire industrial ecosystems (Colledani et al., 2014a). Deming (1982) suggested that a focus on quality first is a key to market domination – where improved quality leads to reduced costs (due to less rework, fewer mistakes, and fewer delays), as well as better use of machines and materials. As such, Zero Defect Manufacturing (ZDM) has emerged as a means of moving closer to achieving an organization's "first-time-right" quality strategy (Raabe et al., 2017). Though the idea of zero defects is not new, it remains in this sense a disruptive concept that is able to entirely reshape the manufacturing ideology – by simultaneously considering production planning, quality management, and maintenance management factors (Psarommatis et al., 2020).

Zero Defects first emerged as a strategy in the US the 1960 s (Halpin, 1966). Much of the development of the zero defect mindset is credited to Philip B. Crosby, who was at that time a quality control department manager on the Pershing Missile program at the Martin Company (Harwood, 1993). In his *Absolutes of Quality Management,* Crosby (1985) suggested that the performance standard must be zero defects, such that managers and workers should not accept any level of non-conformance, and that "*zero defects should be their personal standard*". At around the same time in 1960 s Japan, highly influenced by the teachings of Dr. W. Edwards Deming, Toyota Motor Company launched its Zero Defects Campaign, which became a major stimulus to quality control activities across the organization. *Zero Defects* was further adopted in Toyota's 1968 corporate policy and continued thereafter as a company initiative. In more general terms, these events were quickly followed by the emergence of the Taguchi methods in the 1970 s, and subsequently Six Sigma (particularly at Motorola) in the 1980 s. In the 1990 s and 2000 s, Lean Production and Total Quality Management (TQM) were high on the agenda of most large firms as a means of moving towards a zero defect vision.
ZDM is an emerging paradigm that goes beyond traditional quality approaches such as Lean Production and Six Sigma. It aims for the complete elimination of defects, not simply through detection and correction of defective products and process parameters, but also through defect prediction and prevention. As a technology-intensive concept, ZDM began gaining greater traction on the quality management agenda with the onset of digitalization and Industry 4.0 in the 2010 s, presenting the potential for a whole new wave of digitally enhanced quality management. The term Industry 4.0 was coined in 2011 by a German government initiative to prepare the German manufacturing industry for the digital era (Sinha et al., 2020). Since then, a plethora of emerging key enabling technologies, such as in-line data gathering solutions, data storage and communication standards, data analytics tools and digital manufacturing technologies have begun to

offer new opportunities for ZDM (Eger et al., 2018), enabling organizations to move even closer to achieving the vision of zero defects.

The aim of this paper is to provide a state of the art perspective of ZDM by presenting a thorough and critical (systematic) review of the extant literature. We bring out pertinent factors and useful insights into the contemporary advances in ZDM and identify several interesting research gaps which serve as avenues for future research within this important and emerging field of research.

2. Research design

To investigate the state-of-the-art perspectives of ZDM, we adopted systematic literature review (SLR) as our research method. An SLR is "*a systematic, explicit, comprehensive, and reproducible method for identifying, evaluating, and synthesizing the existing body of completed and recorded work produced by researchers, scholars, and practitioners*" (Fink, 2010).

The SLR process begins with a *planning* phase, where the reviewers clearly identify the purpose and intended goals of the literature review. A review protocol was also developed by the reviewers, which allowed the detailed procedure (documented in the following sections) to be followed. Next is the *selection* phase, where the literature search and screening processes are carried out to select the core literature. Then comes the *extraction* phase, where articles are excluded based on specific quality criteria before the remaining articles are studied to extract the useful data and applicable information. Finally, in the *execution* phase, the data extracted from the literature is synthesised and analysed – before the results can be documented and presented.

An initial search using search terms "Zero Defect" and ""Manufacturing" was performed in the Scopus database. The Scopus database was selected as it covers a satisfactory share of relevant, extant literature and produces less noise, compared to other databases (Bjørnbet et al., 2021). Our initial search returned 477 articles during the period 1965–2021, with a significant share of results stemming from the period from 2017 onwards (as shown in Fig. 1).

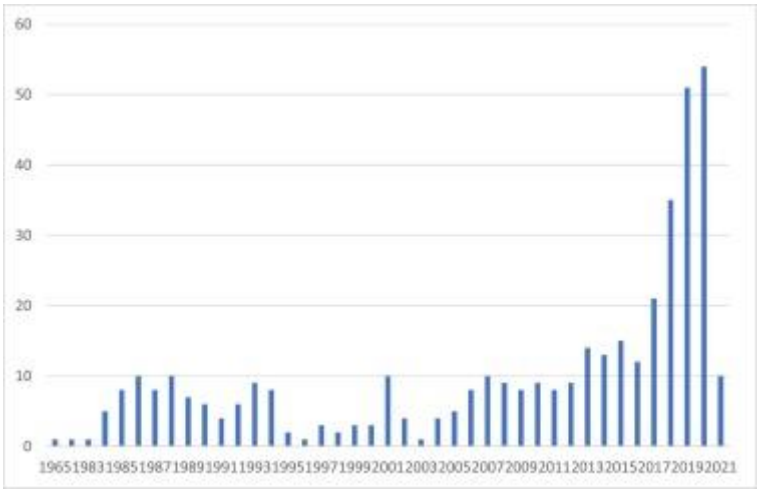

Fig. 1. Zero Defect Manufacturing - Publications per year (Scopus).

The 477 articles were then sorted based on the following criteria (see Table 1.):

- 1. Research articles should demonstrate *rigour* – hence only peer-reviewed journal articles and conference proceedings were included.

- 2. Research articles should be *relevant* – hence only relevant specific subject areas were included (For example, papers from the arts and humanities, astronomy, and medicine fields were rejected at this stage).
- 3. Research articles should be *recent* – hence only articles post-Industry 4.0 (2011 +) were included.

Table 1. Overview of sorting and exclusion process.

Articles included	Articles excluded	Criteria
477	–	Title – abstract – keywords: "Zero Defects" and "Manufacturing"
407	70	RIGOUROUS • Journal articles • Peer-reviewed conf. proceedings
381	26	RELEVANT • Engineering • Computer science • Materials science • Business Management • Decision science
216	165	RECENT • Timespan 2011–2021

The distribution of the articles (publications per year) included in the review is shown in Fig. 2.

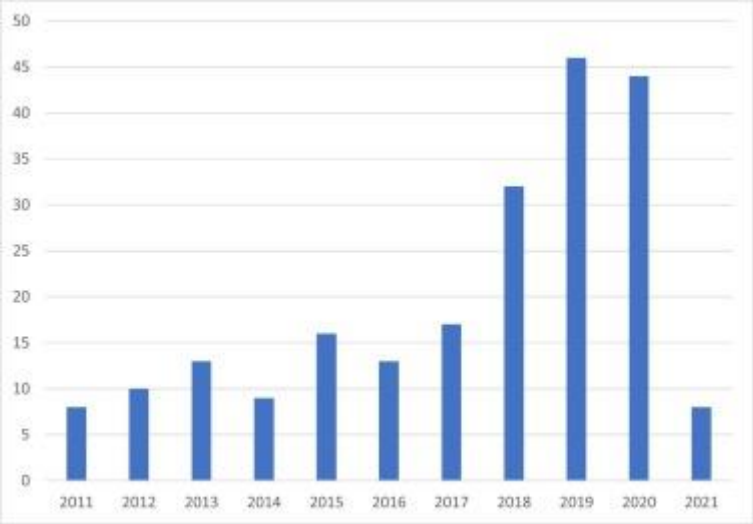

Fig. 2. Distribution of the reviewed literature.

Such a distribution makes this work both timely and significant. For example, the previous state-of-the art review of ZDM presented in Psarommatis et al. (2020) only considers publications in the period 1987–2018, thus approx. 50% of the articles included in this current study of advances in ZDM are new. As such, Psarommatis et al. (2020) provides a suitable underpinning and point of departure for further analysis of more than 100 additional journal articles and peer-reviewed conference publications.

Fig. 3 (above) illustrates the distribution of publication type, where 65% are articles from conference proceedings and 35% are from international journals. Fig. 4 (below) shows the distribution of articles based on country of origin, with nearly 50% of the articles originating from Italy, Germany, and India. Interestingly, the majority of ZDM research originates from continental Europe (Both Manufuture-EU and the European Factories of the Future Research Association (EFFRA) have placed ZDM high on the research agenda since 2011, see MANUFUTURE-EU, 2013 and EFFRA, 2020).

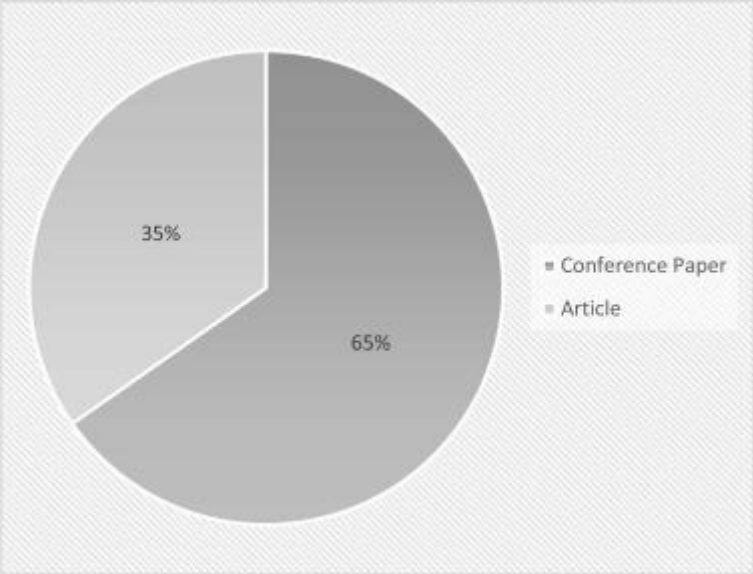

Fig. 3. Publication type.

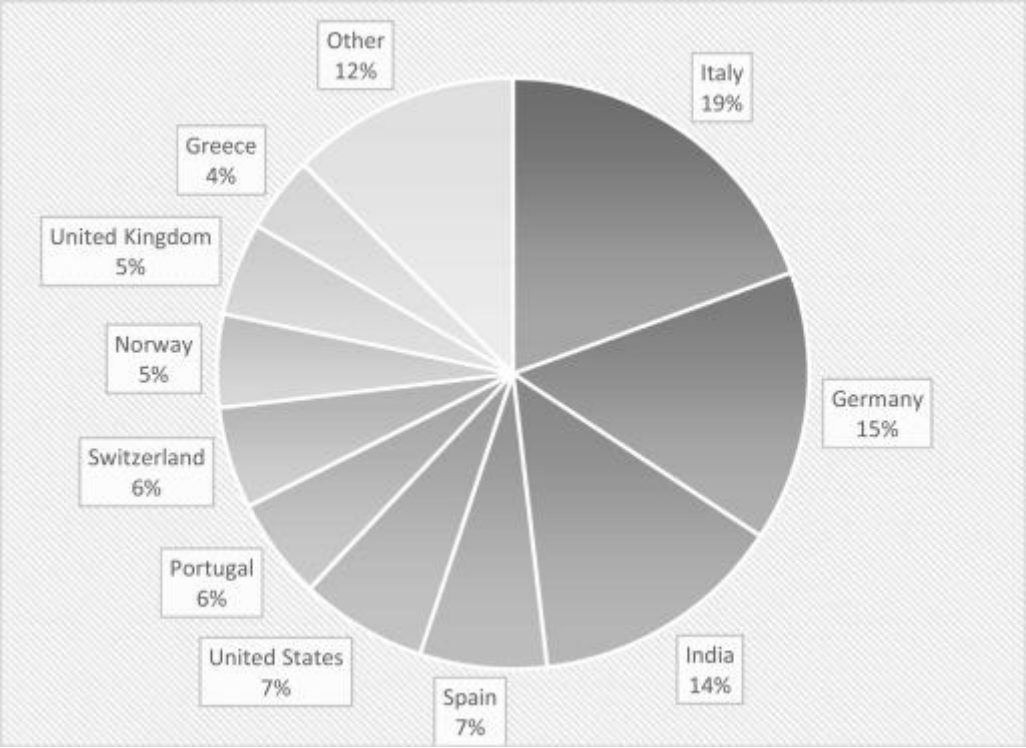

Fig. 4. Country of Origin.

Following the systematic sorting and exclusion process, the remaining 216 articles were then closely examined using a process of interpretive synthesis to identify prominent, recurrent themes and potential variability across the literature. Based on these emergent themes and variables, we were able to forge a frame for which to further classify the extant literature on ZDM:

- 1.Scope: Is the research based on single-stage, multi-stage, or Supply Chain (system) level ZDM?
- 2.Focus: Is the research based on process-centric, product-centric, or people-centric ZDM?
- 3.Type: Is the research purely theoretical or is it applied (with practical examples)?
- 4.Hierarchical level: Does the research present ZDM at a strategic, tactical, or operational level?
- 5.Technology: Which key enabling technologies (KETs) does the research discuss? (e.g., monitoring systems, Digital Twins, Artificial Intelligence, etc.).

Each of these five classification criteria were applied to all papers. It should be noted that several of the papers fell into multiple categories within each classification (E.g., articles considering both process- and product-centric ZDM approaches). This was especially the case regarding KETs, where multiple technologies are often presented together, in individual works. In this respect, we assigned multiple tags to these articles such that we did not risk missing contributions both within and across the various classification schemas. We present the results of this subsequent classification of the rigorous, relevant, and recent extant literature in the following section.

3. Analysis of the state-of-the-art

In this section we present and discuss the results of classifying the rigorous, relevant, and recent ZDM literature to provide a comprehensive overview of the current state-of-the-art.

3.1. Single-stage, multi-stage, or supply chain?

Much of the ZDM literature focuses on the optimization of individual and discrete (single-stage) production processes. However, even after the optimization of a single process, there is still a possibility of defect generation in the form of deviations that propagate in subsequent process steps (Magnanini et al., 2019). Therefore, more recent research has adopted a focus on so-called multi-stage manufacturing systems (Eger et al., 2018), which encompass entire production lines – sometimes consisting of many discrete processes. Beyond multi-stage manufacturing systems, one might also expect to find ZDM strategies for supply chains or digital supply networks. In this section we explore the literature considering these dimensions (see Fig. 5).

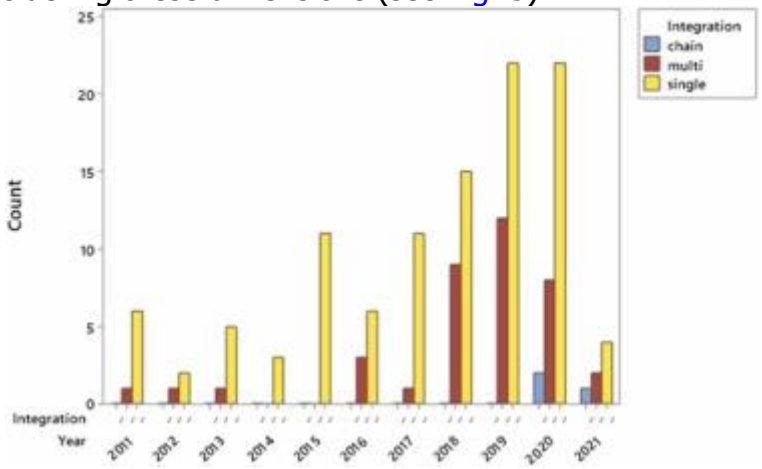

Fig. 5. Single-, multi-stage, or supply chain perspective.

Firstly, there is a clear trend of developing from single-stage to multi-stage and supply chain level ZDM research. However, the majority of both early and contemporary ZDM research has tended to focus on single-stage processes (e.g., Chiou et al., 2011; Arsuaga Berrueta et al., 2012; Myklebust, 2013; Weng and Saeger, 2013; Caggiano et al., 2015; Linares et al., 2015; Kiraci et al., 2017; Montinaro et al., 2018; Eldessouky et al., 2019; Beckert et al., 2020). Around 2018 there was a marked shift toward multi-stage processes in ZDM research (e.g., Colledani et al., 2018; Kang et al., 2019; Lindström et al., 2019; Shiokawa and Ishii, 2019; Tosello et al., 2019; Psarommatis et al., 2020). More recently, one or two instances of supply chain level ZDM research have emerged (e.g., Bosi et al., 2020), though these are few and far between.

3.2. Process, product, or people-centric?

Our next classification of the ZDM literature concerns the dimensions of *process-, product-,* and *people-centricity* (see Fig. 6). For example, Powell et al. (2021) suggest that although much of the existing ZDM literature presents the concept as either a product-centric (defective parts) or process-centric (defective equipment) approach, the recent intensification of research on the roles of humans (e.g., machine operators and assembly workers) in Industry 4.0 raises an important third approach, namely a *people-centric* view.

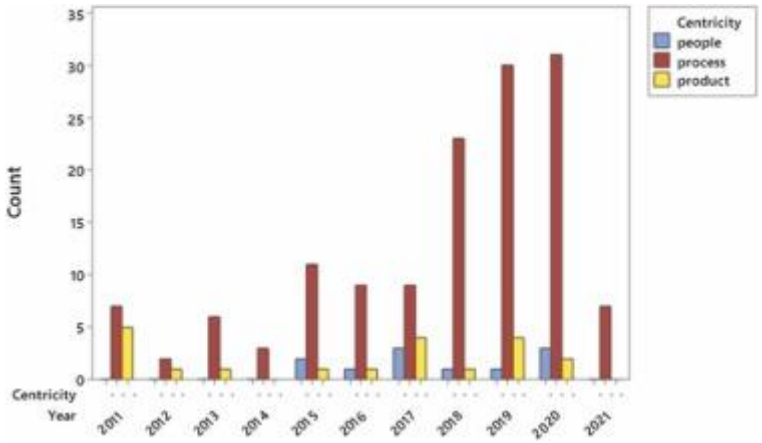

Fig. 6. Process-, product-, or people-centricity.

Again, there appears to be an abundance of ZDM research that focusses on manufacturing processes (e.g., process monitoring, process control, process parameters, etc.). This has been a common theme in the ZDM literature throughout the previous decade (e.g., Chen and Lyu, 2011; Weng and Saeger, 2013; Zoesch et al., 2015; Ngo and Schmitt, 2016; Snel et al., 2017; Montinaro et al., 2018; Magnanini et al., 2019; Papacharalampopoulos et al., 2020). It can be explained as ZDM paradigm builds on SPC concepts, where the process is central with respect to other system components and resources. There also seems to be a trend towards more product-centricity in ZDM research (e.g., Krammer et al., 2017; Alfaro-Isac et al., 2019; Aal et al., 2020). Though the people-centric component of ZDM has begun to appear in the extant research, most of the examples seem to be rather coincidental, often coming secondary to a focus on the process dimension (e.g., Mahmud et al., 2015; Siew et al., 2016; Kang et al., 2019; Steringer et al., 2019; Wang et al., 2019). The role of humans in ZDM has otherwise until now been vastly overlooked, and the few examples of research that include the human element are simply anecdotal (as was also concluded by Psarommatis et al., 2020)).

3.3. Theoretical, or applied?

In this classification, works have been analysed with respect to the theoretical or applied content. *Theoretical* papers have been selected as those in which results are either preliminary (with respect to anticipated further testing in real applications) or are based on restrictive assumptions only. *Applied* papers have been selected as those in which the research is based on real industrial cases and solves specific applied problems.
Much of the extant ZDM literature is based on applied research and presents practical examples of ZDM concepts. An interesting trend can be noticed in Fig. 7. Despite the rising of ZDM paradigm grounded on applied problems, recent research has begun focusing on more general results and theoretical proofs of concept. Data availability which started with Industry 4.0 ten years ago allowed the automated implementation of advanced monitoring solutions, with the aim of process improvement (e.g., Vu et al., 2011), and more accurate measurement solutions for responsive identification of defective products (Chen and Lyu, 2011, Arsuaga Berrueta et al., 2012). Then, researchers focussed on the data elaboration and usage, as well as on the development of model-based methodologies for quality improvement. The main factors which seem to limit the applicability of developed theoretical solutions include the validation of solutions in real contexts (e.g., Bengoechea-Cuadrado et al., 2019; Yeh and Chen, 2019, Yeh, C.-H. and Chen, J.E., 2020, The Decision Mechanism Uses the Multiple-Tests Scheme to Improve Test Yield in IC Testing', in Proceedings - 2020 IEEE International Test Conference in Asia, ITC-Asia 2020, pp. 88–93. doi: 10.1109/ITC-Asia51099.2020.00027; Brito et al., 2020), challenging integration requirements for

multi-source sensors and data fusion (Shiokawa and Ishii, 2019, Bosi et al., 2020), and ZDM frameworks with high-level specifications (Mourtzis et al., 2021, Nazarenko et al., 2021, Psarommatis, 2021).

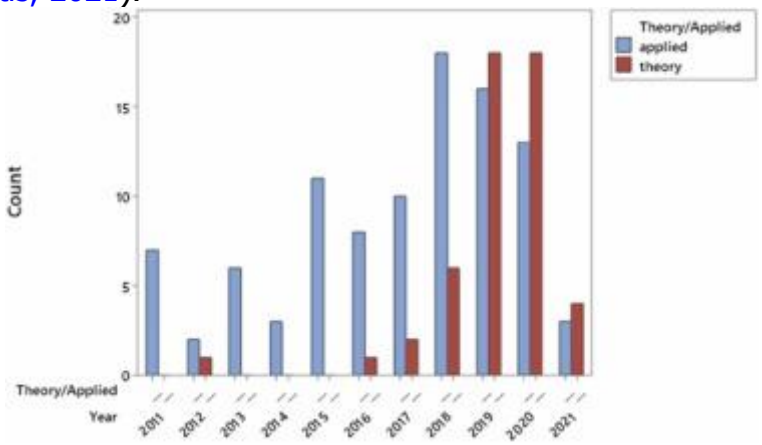

Fig. 7. Theoretical or applied research.

3.4. Strategic, tactical, or operational?

Works have been furtherly classified according to the company level of involvement related to the type of solution/concept presented. A *strategic* level means that the proposed solutions/concepts have a long-term effect on company strategy and concern high-level decisions, such as system configuration/reconfiguration (Mourtzis et al., 2021), including inspection allocation (Shiokawa and Ishii, 2019), supply-chain design (Bosi et al., 2020), multi-level software integration for data management (Schmid and Hanitzsch, 2011), and sensor allocation (Beckert et al., 2020).

A *tactical* level means that the proposed solutions/concepts have a medium-term effect on company policy and concern production decisions which have to be taken regularly, to ensure an effective system behaviour with respect to the identified production goals. Examples include production planning, inspection strategies, and / or maintenance policies (Myklebust, 2013; M Colledani et al., 2014a, Colledani et al., 2014b), but also data mining and analysis methodologies for knowledge extraction and formalization (e.g., Vafeiadis et al., 2017).

Finally, an *operational* level implies that the proposed solutions/concepts involve continuous decisions having a short-term, or even real-time, effect on the system behaviour. This might include rework decisions with respect to product deviations (Schimanski et al., 2016), scheduling (Psarommatis et al., 2020), and monitoring solutions (D'Addona et al., 2015).

In fact, most of the research has focussed on ZDM as an operational endeavour (see Fig. 8). In particular, the sudden spread of methodologies supporting the operational effectiveness of manufacturing systems by integrating data-based and model-based strategies (e.g., Digital Twins and Cyber-Physical Systems) enhanced the research on operational-level results in the last few years. By also considering the analysis with respect to the applicability of solutions, it is interesting to note that recent results on operational strategies also partially belong to theoretical works. This might mean that research is pushing for quite advanced solutions which are encountering implementation challenges in real contexts, as mentioned above.

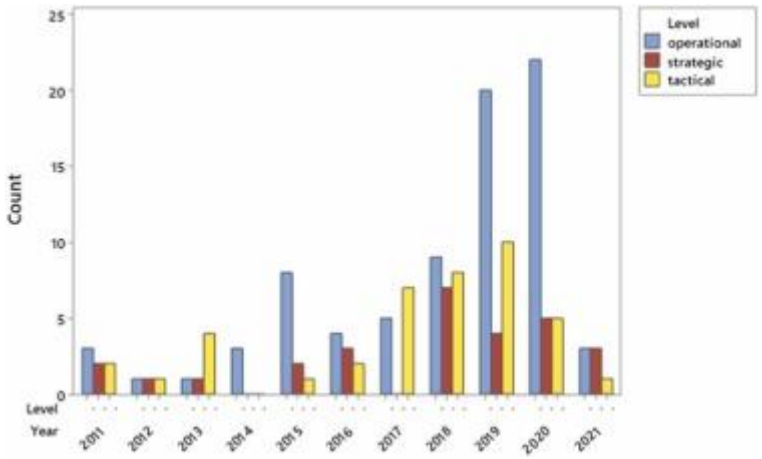

Fig. 8. Strategic, tactical or operational ZDM.

3.5. Key enabling technologies (KET)

Industry 4.0 presents a plethora of technologies (e.g., Zheng et al., 2021), which we consider to be the key enabling technologies of ZDM. As such, we select the following technologies to further classify the analysed works:

- •Artificial Intelligence (AI): data-driven techniques for automated data analysis and decision making
- •Architecture and Standards: integration and communication protocols of industrial software

- •Big Data analytics: elaboration, analysis, and visualization of massive amount of industrial data
- •Cyber-Physical Systems (CPS): control strategies combining physical and digital resources

- •Internet of Things (IoT): multi-source distributed data gathering solutions
- •Inspection and monitoring: solutions for the measurement and monitoring of product and process resources

- •Simulation and modelling: solutions for the implementation of digital counterparts of product/process/systems (as Digital Twins, etc.)

- •Extended Reality (XR): solutions for the integration of virtual and physical representations.

For sake of classification, in works where more than one KET was included, the primary technology has been selected (e.g., when AI is used in a monitoring system, if the focus of the paper is on the development of a data-driven methodology to replace an existing monitoring system, the identified classification is AI. On the other hand, if AI is used to design a new inspection/monitoring system, the identified classification is inspection and monitoring).

Fig. 9 illustrates the spread of various KETs discussed in the extant ZDM literature. We discovered several articles that presented AI (Liang et al., 2016, Liang et al., 2018, O'Brien and Humphries, 2019, Escobar et al., 2020) and digital twin (Papacharalampopoulos et al., 2020, Pombo et al., 2020, Psarommatis, 2021) approaches to ZDM, though there was an abundance of literature that discusses more the architecture and monitoring systems perspectives of ZDM. For example, both Angione et al. (2019) and Magnanini et al. (2020) present seminal work with regard to reference

architectures for ZDM, while Ferretti et al. (2013); Caggiano et al., 2015, Caggiano et al., 2016, Caggiano et al., 2020; and Dimla (2018) each present examples of various monitoring systems for ZDM.

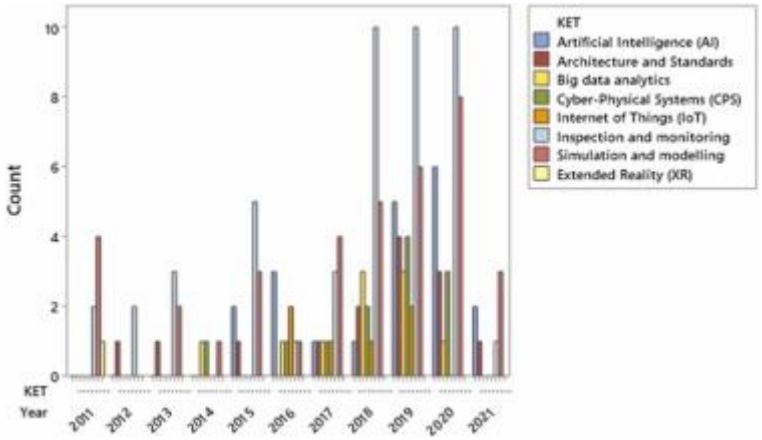

Fig. 9. Key Enabling Technologies.

4. Overview of ZDM strategies

During our analysis and categorization of the ZDM literature, we discovered several complementary *strategies* for ZDM. In this Section, we discuss these ZDM strategies. A ZDM strategy can be defined as the set of tools, resources, and control rules with the aim of avoiding defects in complex manufacturing systems.

In traditional quality strategies, feedback control loops are usually implemented at single-process levels to detect and repair defects, even when the production system is complex and includes more than one stage or machines, as depicted in Fig. 10:

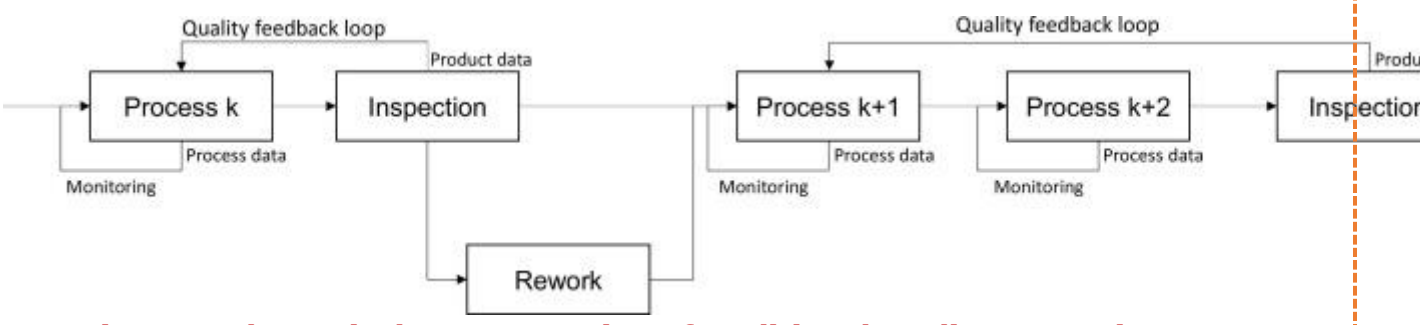

Fig. 10. Schematical representation of traditional quality strategies.

Traditional quality strategies keep separate the analysis of product data, which come from inspection processes, and process data, which comes from in-situ monitoring solutions. In this way, quality control loops are triggered only by inspection stages, which may come significantly later than the process in which the defect could have originated. Thus, quality strategies are usually implemented as feedback loops, leading to issues such as delay in the defect identification, difficult root-cause analysis for quality problems, defect detection and repair / rework as a main correction strategy, and lack of concurrent analysis of product and process data.

On the other hand, ZDM strategies aim at proactively identifying defects or potential defects and attempt to find methods that (1) prevent defects in the first instance and (2) avoid rework by compensating for defects and deviations downstream in the process chain, by means of feedforward control loops. A schematical representation of such ZDM strategies is depicted in Fig. 11. As shown, the ZDM paradigm grounds on the integration of product and process data coming from multi-source process chains.

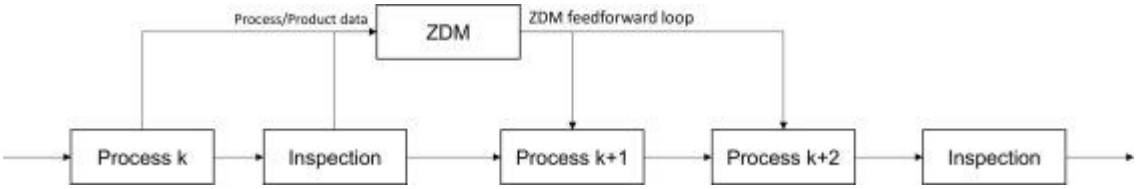

Fig. 11. Schematical representation of ZDM strategies.

In the following sections, we describe these two ZDM strategy types in more detail.

4.1. Defect prevention

Defect prevention can be achieved when the process is known in depth and a machine state analysis is done so that process conditions leading to defects or possible deviations of the product from expected outcome are proactively identified. According to the extant literature, some of the main situations where this strategy could be successfully applied are (i) production systems based on chemical and thermal processes, and (ii) multi-stage machining systems.

In case (i), the type of chemical and thermal reaction occurring in pharmaceutical production or semiconductor fabrication, depends strongly on machine condition. Moreover, in this type of production, defect compensation or mitigation is quite difficult, due to the continuous nature of the process. Hence, to reach a zero-defect condition, quality strategies should focus on defect avoidance. Some examples are presented in (Huang et al., 2018) with respect to the semiconductor fabrication, and in (Dengler et al., 2021) in relation to pharmaceutical production.

In case (ii), multi-stage machining systems are characterized by propagation of dimensional deviations, which may not be identified as defects at single-stage level, but that together accumulate and present a defect at the end of the production line. Hence, the prediction of defects according to process conditions avoid the propagation of deviations along the process chain (Du, Ho and Kaminski, 2021).

4.2. Defect mitigation or compensation

Defect compensation strategies are typical of those production systems where product quality strongly depends on dimensional and geometrical features. Defect compensation can be widely used as ZDM strategy to replace rework activities, which wastes time and resources and does not add value with respect to the core product process chain. Some of the main applications of ZDM compensation strategies can be found in (i) multi-stage machining systems, (ii) assembly systems.

In multi-stage machining systems, well-known methodologies such as stream-of-variation can be used to adapt the downstream process (usually by acting on fixture positioning) to avoid the propagation of dimensional and geometrical deviations of the measured part (Magnanini et al., 2019). If a model-based solution is not available, due to the line complexity, specific downstream compensation actions can be defined, without the need of off-line rework (e.g., Eldessouky et al., 2019; Eger et al., 2020).

In assembly systems, components which are individually within tolerance may result in a defective assembled product due to the intrinsic parts variability. Hence, compensation strategies such as selected assembly, where components are matched in order to minimize the expected assembled product deviation, could support in avoiding rework or

even end-of-line inspection resulting in scrap products (M. Colledani et al., 2014a, Colledani et al., 2014b).

5. Gap analysis and future research paths

In this section we provide a narrative of ZDM research gaps as identified by Psarommatis et al. (2020) and build on this seminal work by offering further directions for future research.

5.1. Research gaps

Table 1. presents the ZDM research gaps and narrative as offered by Psarommatis et al. (2020).

Research Direction (Psarommatis et al., 2020)	Empty Cell
Shift from local to global solutions	*An effective zero defect manufacturing system can only be achieved by adopting a holistic approach - not only to achieve zero defects but also to maximise quality and performance* via *integration of four ZDM strategies (detection, repair, prediction, and prevention). Though there are currently many collaborative projects (both at national and international scale) aiming at achieving such ZDM systems, high impact scholarly papers on the subject are yet to be published.*
Investigate pros and cons	*One of the most significant advantages of zero defect manufacturing is cost reduction due to waste elimination. Nonetheless, having the goal of manufacturing with zero defects may result in negative impact on other performances in trade-off such as time and resources required to achieve such an objective. However, many of the previous studies investigating the pros and cons of zero defect manufacturing specifically are quite few, and a more thorough analysis on the subject should be considered for further research in the field.*
Role of people and human activities in manufacturing	*The most important aspect of manufacturing is sometimes largely neglected: people. The manufacturing system is often viewed simply as a collection of processes and / or process chains only. However, manufacturing quality is often significantly impacted by the human-in-the-loop. The role of people in ZDM should be investigated further. This is significantly under-*

Research Direction (Psarommatis et al., 2020)	Empty Cell
New business models for ZDM	*researched and is certainly a topic to be explored further.* *Financial analyses from the business point of view are also missing from much of the extant ZDM literature. Therefore, future research must provide economic information regarding the performance of particular ZDM use cases, and provide further insight into business aspects and benefits concerning the implementation of the specific ZDM methods.*

We suggest that although these research directions are both relevant and timely based on earlier extant literature, through our analysis we can be more specific in terms of future research opportunities. As such, these are described in the following section.

5.2. Future research opportunities

Based on the aforementioned research gaps, we identify the following five areas for future ZDM research. These areas are further grouped in two specific streams – advancing ZDM research and overcoming the global application challenges of ZDM.

Advancing ZDM.

- 1.Beyond ZDM: Zero-waste value-chain strategies
- 2.Fast transfer of ZDM solutions for First-Time-Right and quality ramp-up minimization
- 3.Human-in-the-loop

Overcoming the global application challenges of ZDM

- 4.Information & communication technology (ICT) solutions for the secure horizontal and vertical data integration
- 5.Extension of defect prevention and compensation ZDM strategies to less explored manufacturing processes

We present an overview of the future research themes as well as a Research Framework for Advancing ZDM (Fig. 12) in the following sections:

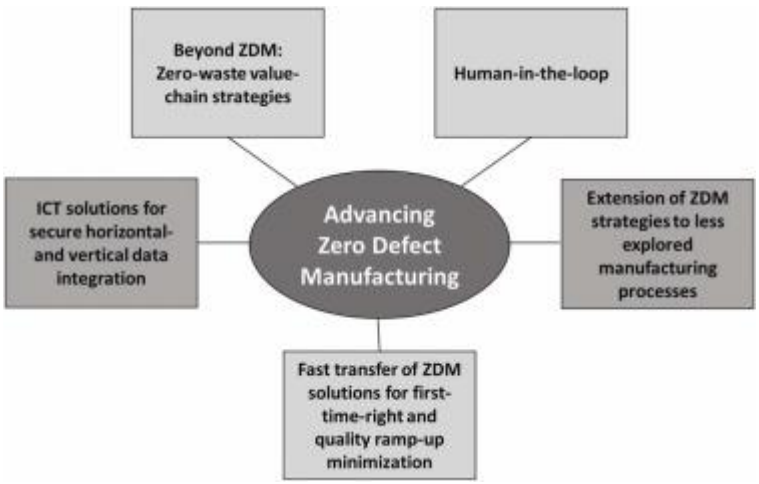
Beyond ZDM: Zero-waste value-chain strategies
Human-in-the-loop
ICT solutions for secure horizontal- and vertical data integration
Advancing Zero Defect Manufacturing
Extension of ZDM strategies to less explored manufacturing processes
Fast transfer of ZDM solutions for first-time-right and quality ramp-up minimization

Fig. 12. A Research Framework for Advancing Zero Defect Manufacturing.

As the analysis of the state of the art has shown so far, research on ZDM strategies and solutions have reached already a good level of maturity. Hence, the available research should push towards the technological transfer of the ZDM solutions to the global industry, while going forward in the theoretical research. Grounded on this view, the following paragraphs focus on the characterization of research guidelines and directions, to boost ZDM research and applications in practice.

5.3. Research directions to advance ZDM

5.3.1. Beyond ZDM: Zero-waste strategies at value-chain

In its core, ZDM aims to achieve zero defects in a production system: scrap reduction, lower production costs, shorter production times, higher productivity, and a higher resource and energy efficiency. In the last decade, the strong focus on digitalizing the manufacturing environment has pushed the ZDM frontier to apply several Industry 4.0 technologies even closer to zero defects. However, the increasing emphasis on sustainable production requires that manufacturing companies continuously deliver higher quality products of increasing complexity at lower cost, while limiting the use of resources within entire industrial ecosystems. One of the four distinctive strategies in ZDM is to repair and increase parts and product lifetime. The ZDM can be basis to transform the traditional manufacturing chain from linear to circular by finding ways to repair and re-use materials, parts, and products to last more than only one product lifecycle.

To move towards zero waste, ZDM must integrate circular economy initiatives and sustainability aspects. To this aim, following progresses beyond current state-of-the-art should be attained: (i) Non-destructive inspection methods and quality monitoring solutions to detect defects without consuming or wasting material; (ii) Diagnostics and defect avoidance methods should be developed to prevent and predict defects and waste; (iii) Circular value-capture solutions aiming at the re-use, re-cycle, re-manufacture of products or defective products to minimize the effect on the environment.

5.3.2. Fast transfer of ZDM solutions for First-Time-Right and quality ramp-up minimization

In a continuously evolving context, manufacturing companies must adapt quickly and react fast to changes. Manufacturing systems have reached a mature level of reconfiguration capabilities thanks to technological and software innovations. However, companies still struggle to adapt production strategies, as ZDM solutions, to new or changed manufacturing systems. Firstly, this occur because often ZDM strategies have been optimized for the specific use-case. Secondly, the effort in data gathering, modelling, and optimization takes much time with respect to the actual system reconfiguration or product changeover. This is even more evident in manufacturing contexts characterized by one-of-a-kind production, where general first-time right solutions are extremely challenging, and where data availability is very limited, e.g., manufacturing of large parts for energy applications. Moreover, these sectors are usually characterized by strict quality requirements and high precision. Hence, companies find themselves in continuous ramp-up phase with respect to the production. To tackle this

issue and achieve the first-time right, solutions dedicated to the knowledge transfer of ZDM strategies from one product to another (as well as fast model generation and parameter tuning) should be studied. At the same time, more integrated approaches for the product design and engineering could be explored, for companies to gather and distribute knowledge about production not only at shop-floor level but also in departments which are usually treated separately with respect to production.
The goal of this research direction is therefore to study integrated solutions for the design, engineering, and manufacturing of scalable ZDM solutions, which could formalize and make available the distributed and unstructured knowledge of a company.

5.3.3. Human-in-the-loop

Until recently, ZDM has neglected manual-intensive manufacturing processes, having focused on more automated processes. However, given the available technological solutions for operator assistance, as well as the spread of human-robot collaboration systems, the human factor cannot be neglected anymore. When the human factor is kept in the loop, capabilities become extremely flexible. Moreover, the empowerment and training of workforce allow for clear improvements. Important aspects are represented also by the existing knowledge in people-centric processes, as product and process design, as well as manual or partially manual processes, e.g., assembly or human-robot collaborations.

In this context, knowledge capturing, transferring and distribution between workforce as well as production phases becomes both challenging and promising. For instance, in assembly operations, tasks to ease the assembly and allow a better knowledge of the process for instructions and quality verification represent a possible direction of research. At the same time, the relation between human processes and quality has been rarely investigated, for clear data privacy issues and modelling challenges. Nevertheless, research should allow for solutions where the human knowledge and capabilities are enhanced, and where digitalization supports the workforce, who represents the real innovation source in manufacturing and have the real resilience capabilities in unexpected contexts.

5.4. Research directions to overcome application challenges of ZDM in global industry

5.4.1. Information technology solutions for the secure horizontal and vertical data integration

When ZDM solutions are to be implemented in industries, issues like data security and data safety to gather, integrate and re-elaborate data from different sources and software will need to be solved. As it has been noticed within the state of the art analysis, most of the applied research focus on the implementation of specific solutions within the manufacturing company borders, and especially at shop-floor level. However, more advanced ZDM solutions which have been proposed within the years by researchers lack application also because of implementation complexity with respect to available software solutions for the secure horizontal and vertical data integration. In this context, horizontal data integration should aim at the development of Key Enabling Technologies (KET) to integrate and fuse data from different sources, as ERP, MES and PLM, while vertical data integration should focus on the data sharing among companies to follow the product life-cycle.

Challenges for this objective include the generalization of data models for scalable solutions, the development of secure and standardized communication protocols, as well

as advanced data mining solutions to store and use available data. It should also be mentioned that the success of this research direction is the key for the widest applicability of ZDM solutions not only to Large Enterprises, but also to Small and Medium Enterprises (SMEs), which usually suffer of the so-called digital divide. Hence, results of the proposed research direction would enhance the competitiveness of SMEs, which represent most European companies.

5.4.2. Extension of defect prevention and compensation strategies to less explored manufacturing processes

The analysis performed in the previous Sections has shown that the wide number of ZDM solutions introduced by researchers has on the other hand been applied to a restricted number of manufacturing technologies and processes. To overcome this issue, challenges for the extension of defect prevention and compensation strategies to less treated manufacturing processes should be understood.

For instance, ZDM solutions for continuous processes are yet to be explored. Indeed, continuous manufacturing processes are complex, often they rely on thermal transformation which makes difficult the characterization of defect compensation. To this aim, inspection solutions and advanced monitoring become extremely relevant when dealing with continuous processes. Indeed, in this case defect prevention solutions should represent the objective of the research. Defect prevention implies high knowledge of the underlying process, which is often translated into advanced model-based Digital Twins of the process for the proactive identification of deviating process condition leading to defective output. Hence, one of the objectives for this research direction would be to focus on continuous production, characterized by complex multi-stage dynamics and evolving product material properties. Examples are steel extrusion, pharmaceutical production, food production and semiconductor fabrication, where the synchronization between production stages must be extremely accurate in order to avoid the excess of product permanence in specific stages which would be resulting in defective output, e.g. ovens, or where process parameters must adapt to the product characteristics obtained by means of chemical or thermal transformation acting on the material properties, e.g. extrusion of steel bars.

6. Conclusion

Through adopting SLR as our research method, the aim of this paper was to present a thorough and critical review of literature with the objective of bringing out pertinent factors and useful insights into developments and advances in Zero Defect Manufacturing (ZDM). The academic literature available on ZDM was critically reviewed and classified into the most prominent subject areas, which were (i) scope (single-, multiple-, or system-level); (ii) focus (product-, process-, or people-centricity); (iii) type (theoretical or applied); (iv) hierarchical level (strategic, tactical, or operational); and (v) technology (KETs). By analysing each of these areas, some specific directions for further research have been identified, and were used to develop the research framework for advancing ZDM (shown in Fig. 12)

.

Although this literature review may not be exhaustive, it serves as a scientifically grounded and comprehensive base for understanding the application, implications, and further developments of ZDM. As such, the work makes a significant theoretical contribution in that we have mapped specific requirements for the future research of academics and scholars aiming to study and advance the field of ZDM. We also contribute to practice by providing factors and insights for practitioners to consider when designing

and implementing ZDM solutions, in practice, beyond discrete, single process applications. As Psarommatis et al. (2020) points out, there is a particular synergy to be realised through well-structured collaboration between industry and academia. Therefore, we suggest that these goals are best achieved through action-oriented research, in practice.

We also discovered that much of the research focussed on detecting and fixing defects, rather than predicting and preventing them. Though much can be learned from defect detection and repair, we suggest that these should not be considered zero defect strategies – where *"right-first-time"* is the recognized standard. We therefore identified two core ZDM strategies – *defect prevention* and *defect compensation* – both of which present important areas for further research in ZDM.

Additionally, future ZDM research must stretch beyond individual processes and factory shopfloors to involve other critical functions. For example, we also discovered a lack of the adoption of a systems perspective in current ZDM research. Though an operational perspective is critical to succeeding with ZDM, the key to eliminating defects is to understand the company as a system. Thus, future ZDM research should also include product development and market perspectives to close the loop and foster continuous improvement and organization-wide learning (early Zero-Defect research considered design and engineering functions, though recent efforts consider only digitalization of the shop floor). For example, current ZDM research focusses on producing zero-defect products. However, the manufacturing phase can often still be too late to avoid or compensate for defects. Hence, future research should focus on the re-design of products to further avoid defects which have been detected during the manufacturing or use phase. This implies that information about the manufacturing and use should become accessible to product designers. This research direction will also put the human factor at the centre of ZDM, since design and engineering is still very much a people-centric activity. Research in this field should focus on the integration of multi-source data from product life-cycles, and knowledge extraction and formalization that can be re-applied in the design phase.

Future ZDM research should also consider sustainability and green economy initiatives. For example, ZDM for Zero Waste is currently an important focus area on the European research agenda (Horizon Europe, 2021) that should combine ZDM efforts with Circular Economy approaches. As such, from the perspective of control actions, sustainability should also be emphasized, to have not only zero-defect products and processes, but also zero-waste production systems.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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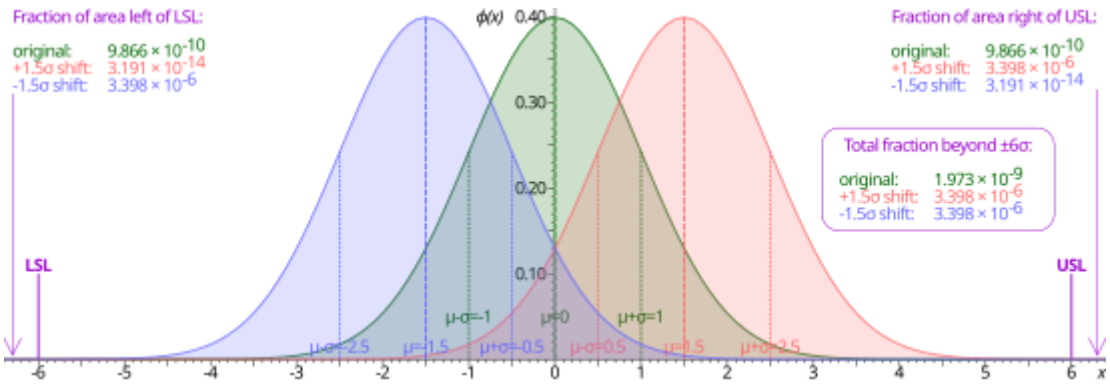
Six Sigma

Etymology



Normal distribution underlies the statistical assumptions of Six Sigma. At 0, μ (mu) marks the mean, with the horizontal axis showing distance from the mean, denoted in units of standard deviation (represented as σ or sigma). The greater the standard deviation, the larger the spread of values; for the green curve, μ = 0 and σ = 1. The upper and lower specification limits (USL and LSL) are at a distance of 6σ from the mean. Normal distribution means that values far away from the mean are extremely unlikely—approximately 1 in a billion too low, and the same too high. Even if the mean were to move right or left by 1.5 standard deviations (also known as a 1.5 sigma shift, colored red and blue), there is still a safety cushion.

History

Motorola pioneered Six Sigma, setting a "six sigma" goal for its manufacturing business. It registered Six Sigma as a service mark on June 11, 1991 (U.S. Service Mark 1,647,704); on December 28, 1993, it registered Six Sigma as a trademark. In 2005 Motorola attributed over $17 billion in savings to Six Sigma.

Honeywell and General Electric were also early adopters of Six Sigma. As GE's CEO, in 1995 Jack Welch made it central to his business strategy. In 1998 GE announced $350 million in cost savings thanks to Six Sigma, which was an important factor in the spread of Six Sigma (this figure later grew to more than $1 billion). By the late 1990s, about two thirds of the Fortune 500 organizations had begun Six Sigma initiatives with the aim of reducing costs and improving quality.

In recent years, some practitioners have combined Six Sigma ideas with lean manufacturing to create a methodology named Lean Six Sigma. The Lean Six Sigma methodology views lean manufacturing, which addresses process flow and waste issues, and Six Sigma, with its focus on variation and design, as complementary disciplines aimed at promoting "business and operational excellence".

In 2011, the International Organization for Standardization (ISO) published the first standard "ISO 13053:2011" defining a Six Sigma process. Other standards have been created mostly by universities or companies with Six Sigma first-party certification programs.

What is SIX Sigma?

Six Sigma is a method that provides organizations tools to improve the capability of their business processes. This increase in performance and decrease in process variation helps lead to defect reduction and improvement in profits, employee morale, and quality of products or services.

"Six Sigma quality" is a term generally used to indicate a process is well controlled (within process limits ±3s from the center line in a control chart, and requirements/tolerance limits ±6s from the center line).

- 01] Differing opinions on the definition of Six Sigma
- 02] What is lean Six Sigma?
- 03] Integrating lean and Six Sigma
- 04] Implementing Six Sigma

01] Differing opinions on the definition of Six Sigma

The differing definitions below have been proposed for Six Sigma, but they all share some common threads:

- The use of teams that are assigned well-defined projects that have a direct impact on the organization's bottom line.
- Training in "statistical thinking" at all levels and providing key people with extensive training in advanced statistics and project management. These key people are designated "Black Belts." Review the different Six Sigma belts, levels, and roles.
- Emphasis on the DMAIC approach to problem solving: define, measure, analyze, improve, and control.
- A management environment that supports these initiatives as a business strategy.

Philosophy**:** The philosophical perspective of Six Sigma views all work as processes that can be defined, measured, analyzed, improved, and controlled. Processes require inputs (x) and produce outputs (y). If you control the inputs, you will control the outputs. This is generally expressed as y = f(x).

Set of tools**:** The Six Sigma expert uses qualitative and quantitative techniques or tools to drive process improvement. Such tools include statistical process control (SPC), control charts, failure mode and effects analysis (FMEA), and process mapping. Six Sigma professionals do not totally agree as to exactly which tools constitute the set.

Methodology**:** This view of Six Sigma recognizes the underlying and rigorous DMAIC approach. DMAIC defines the steps a Six Sigma practitioner is expected to follow, starting with identifying the problem and ending with the implementation of long-lasting solutions. While DMAIC is not the only Six Sigma methodology in use, it is certainly the most widely adopted and recognized.

Metrics**:** In simple terms, Six Sigma quality performance means 3.4 defects per million opportunities (accounting for a 1.5-sigma shift in the mean).

02] What is lean Six Sigma?

Six Sigma focuses on reducing process variation and enhancing process control, whereas *lean* drives out waste (non-value-added processes and procedures) and promotes work standardization and flow. The distinction between Six Sigma and lean has blurred, with the term "lean Six Sigma" being used more and more often because process improvement requires aspects of both approaches to attain positive results.

Lean Six Sigma is a fact-based, data-driven philosophy of improvement that values defect prevention over defect detection. It drives customer satisfaction and bottom-line results by reducing variation, waste, and cycle time, while promoting the use of work standardization and flow, thereby creating a competitive advantage. It applies anywhere variation and waste exist, and every employee should be involved.

03] Integrating lean and Six Sigma

Lean and Six Sigma both provide customers with the best possible quality, cost, delivery, and a newer attribute, nimbleness. There is a great deal of overlap between the two disciplines; however, they both approach their common purpose from slightly different angles:

• Lean focuses on waste reduction, whereas Six Sigma emphasizes variation reduction.

• Lean achieves its goals by using less technical tools such as kaizen, workplace organization, and visual controls, whereas Six Sigma tends to use statistical data analysis, design of experiments, and hypothesis testing.

Often successful implementations begin with the lean approach, making the workplace as efficient and effective as possible, reducing waste, and using value stream maps to improve understanding and throughput. If process problems remain, more technical Six Sigma statistical tools may then be applied.

04] Implementing Six Sigma

Six Sigma implementation strategies can vary significantly between organizations, depending on their distinct culture and strategic business goals. After deciding to implement Six Sigma, an organization has two basic options:

1. Implement a Six Sigma program or initiative
2. Create a Six Sigma infrastructure

Option 1: Implement a Six Sigma Program or Initiative

With this approach, certain employees (practitioners) are taught the statistical tools from time to time and asked to apply a tool on the job when needed. The practitioners might then consult a statistician if they need help. Successes within an organization might occur; however, these successes do not build upon each other to encourage additional and better use of the tools and overall methodology.

When organizations implement Six Sigma as a program or initiative, it often appears that they only have added, in an unstructured fashion, a few new tools to their toolbox through training classes. One extension of this approach is to apply the tools as needed to assigned projects. It's important to note, however, that the selection, management, and execution of projects are not typically an integral part of the organization.

Implementing a Six Sigma program or initiative can present unique challenges. Because these projects are often created at a low level within the organization, they may not have buy-in from upper management, which may lead to resistance from other groups affected by the initiative. In addition, there typically is no one assigned to champion projects across organizational boundaries and facilitate change.

A Six Sigma program or initiative does not usually create an infrastructure that leads to bottom-line benefits through projects tied to the strategic goals of the organization. Therefore, it may not capture the buy-in necessary to reap a large return on the investment in training.

For true success, executive-level support and management buy-in is necessary. This can help lead to the application of statistical tools and other Six Sigma methodologies across organizational boundaries.

Option 2: Create a Six Sigma Infrastructure

Instead of focusing on the individual tools, it is best when Six Sigma training provides a process-oriented approach that teaches practitioners a methodology to select the right tool, at the right time, for a predefined project. Six Sigma training for practitioners (Black Belts) using this approach typically consists of four weeks of instruction over four months, where students work on their projects during the three weeks between sessions.

Deploying Six Sigma as a business strategy through projects instead of tools is the more effective way to benefit from the time and money invested in Six Sigma training.

Consider the following Six Sigma deployment benefits via projects that have executive management support:

- Offers bigger impact through projects tied to bottom-line results
- Utilizes the tools in a more focused and productive way
- Provides a process/strategy for project management that can be studied and improved
- Increases communications between management and practitioners via project presentations

- Facilitates the detailed understanding of critical business processes
- Gives employees and management views of how statistical tools can be of significant value to organizations
- Allows Black Belts to receive feedback on their project approach during training
- Deploys Six Sigma with a closed-loop approach, creating time for auditing and incorporating lessons learned into an overall business strategy

A project-based approach relies heavily on a sound project selection process. Projects should be selected that meet the goals of an organization's business strategy. Six Sigma can then be utilized as a road map to effectively meet those goals.

Initially, companies might have projects that are too large or perhaps are not chosen because of their strategic impact to the bottom line. Frustration with the first set of projects can be vital experience that motivates improvement in the second phase.

Six Sigma is a long-term commitment. Treating deployment as a process allows objective analysis of all aspects of the process, including project selection and scoping. Utilizing lessons learned and incorporating them into subsequent waves of an implementation plan creates a closed feedback loop and real dramatic bottom-line benefits if the organization invests the time and executive energy necessary to implement Six Sigma as a business strategy!

{ Source: https://asq.org/quality-resources/six-sigma }

The Elements of Six Sigma Methodology:

In practice, Six Sigma follows one of two sub-methodologies:

DMAIC and DMADV

DMAIC is the acronym for:

- Define – What is important?
- Measure – How are we doing?
- Analyze – What is wrong?
- Improve – What needs to be done?
- Control – How do we guarantee performance?

- **Define** the problem, the customer, the project requirements, and the ultimate goals and expectations of the customer. During this phase, projects are selected, research is conducted to determine various opportunities and possibilities, and the scope of the project is established.
- **Measure** performance of the current process by establishing a data collection plan to determine defects and gather metrics. At this stage, it's important to establish performance baselines, future goals, and how performance will be measured.
- **Analyze** the process to establish root cause of variations and defects to identify issues with the current strategy that stand in the way of the end goal. During the analyze phase, it's important to use data to identify parameters and inputs that have the most significant impact on the final process.
- **Improve** the process by eliminating root causes of defects through innovative solutions. During the improve phase, the focus is on testing the best potential solutions identified in the earlier phases. It's important to consider performance, cost, implementation demands, and risks or disruptions that may arise.
- **Control** the new process to avoid falling into old habits and to ensure it stays on track. During this final phase, all changes made to the process are documented, the root cause of every problem is explained, and a schedule is established for continued monitoring.

Six Sigma DMADV: The Six Sigma DMADV framework includes five stages:

- **Define** realistic goals that suit customer requirements or the business strategy. In this stage, project goals are established, schedules and guidelines are drafted for review, and

risks are identified. A clear plan for the project should emerge by the end of this stage, and the overall strategy should be aligned with customer expectations.

- **Measure** and identify the customer's critical to quality (CTQ) requirements and translate these into project goals. During this stage, the team identifies requirements, market comparisons, key design elements, and any necessary design components for the project. By the end of this stage, it's important to have a set of metrics for aligning with customer requirements and overall project goals.

- **Analyze** multiple options and alternatives for the customer along with the estimated total life cycle of the project. This stage is all about building conceptual designs, identifying the best requirements and components, and determining the total cost of the project. The analyze stage is intended to set up the project with a defined design option that can be tested and prototyped.

- **Design** the process at a high level before moving onto a more detailed version that will become the prototype to identify errors and make modifications. During the design stage, the final details of the design are established, and a model is built that is one step away from a functioning prototype.

- **Verify** that the final iteration of the product or process is approved by all customers and clients — whether internal or external. The final design is presented to all the key stakeholders to ensure that it's the right fit and that it will be effective in real-world use cases. This is the stage where you'll document the process, all changes, and plans to implement the process so that it's scalable and sustainable.

DMAIC v. DMADV

The DMAIC and DMADV methodologies seem similar, but they have different use cases. The DMAIC methodology is designed for existing process or products that aren't meeting customers' needs or performing to standards. When a business needs to develop a product or process that doesn't already exist or when a product has been optimized but still falls short, that's when you want to use DMADV.

*_*_*_*_*_*_*_*_*_*_*

Six Sigma Certification

Typically, Six Sigma certification and training is offered directly by businesses, with GE and Motorola paving the way by being the first to develop Six Sigma certification programs to verify proficiency in the Six Sigma methodology. Large companies and universities soon followed suit, offering their own versions of a Six Sigma certification program.

However, there isn't much oversight to what qualifies as Six Sigma certification and the criteria for Green Belt and Black Belt certifications can vary. Certification programs are offered through businesses, universities, professional associations, and for-profit training organizations. Some notable organizations include:

- Accenture
- American Society for Quality
- Boston University
- Cornell University
- Dartmouth College
- GE
- IASSC
- Motorola Solutions
- Purdue University

Some organizations offer Six Sigma accreditation. For example, the IASSC offers Lean Six Sigma credentialing and accredited training providers. The Council for Six Sigma Certification also offers a list of accredited Six Sigma providers. Ultimately, when choosing a Six Sigma certification or training program, it's important to do your research to ensure the organization, university, or third-party vendor offers the right training for your needs and has the right qualifications.

Training Options

Six Sigma White Belt

Six Sigma Yellow Belt

Six Sigma Green Belt

Six Sigma Black Belt

Six Sigma Master Black Belt

Please visit the following Web Pages to know MORE

01] https://www.youtube.com/watch?v=4EDYfSl-fmc [Video]
[Six Sigma In 9 Minutes | What Is Six Sigma? | Six Sigma Explained | Six Sigma Training | Simplilearn]

02] https://www.sixsigmacouncil.org/six-sigma-certifications/
[for Six Sigma Certification]

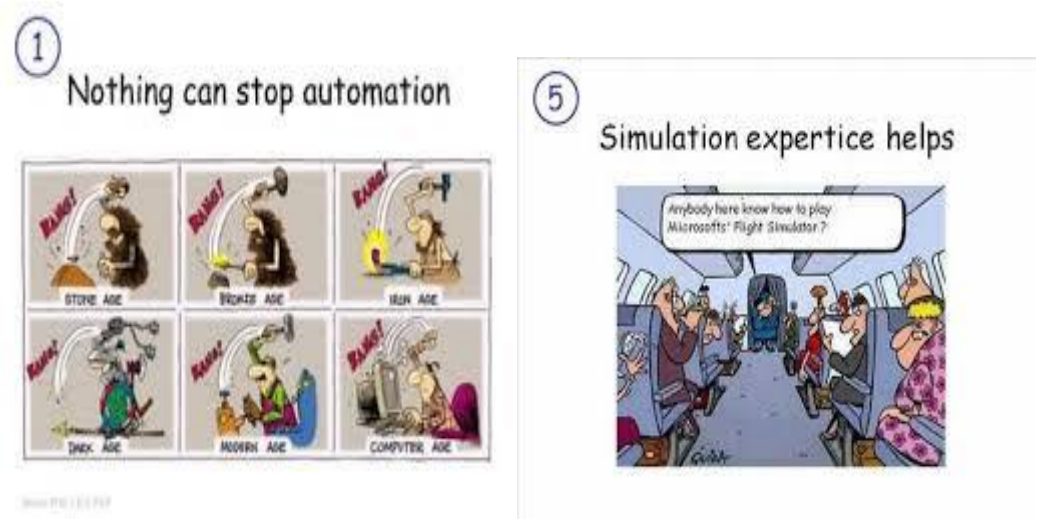
03] https://www.cio.com/article/227977/six-sigma-quality-management-methodology.html

04] https://www.6sigma.us/six-sigma.php

05] https://www.investopedia.com/terms/s/six-sigma.asp

06] https://asq.org/quality-resources/six-sigma

07] https://en.wikipedia.org/wiki/Six_Sigma



CAN I JUST FLAG MY CONCERNS VIZ THE CFO'S DISEMPOWERMENT SITUATION RE THE PROJECTED COUNTER-DOWNSIZING MONIES...
YOU'RE ALL REDUNDANT
SIMULTANEOUS TRANSLATION

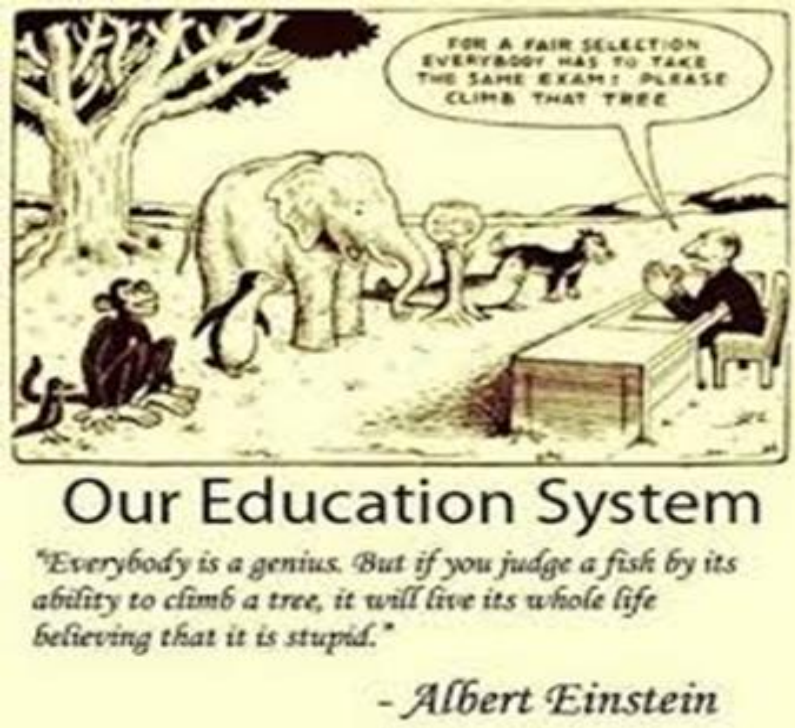
YOU'VE GOT TO IMPLEMENT A SIX SIGMA PROGRAM OR ELSE YOU'RE DOOMED.
ARENT YOU THE SAME CONSULTANT WHO SOLD US THE WORTHLESS TQM PROGRAM A FEW YEARS AGO?
I ASSURE YOU THAT THIS PROGRAM HAS A TOTALLY, TOTALLY DIFFERENT NAME.
WHEN CAN WE START?
www.dilbert.com

And exactly how much less did it cost to implement Five Sigma instead of Six, Dwayne?

WHAT IS LEAN SIX SIGMA?
6σ
6σ
LEAN
SIX SIGMA
LEAN SIX SIGMA

4
Users don't like bugs
O.k., and now you'll do exactly what I'm telling you !

CAROL, SCHEDULE A STAFF MEETING.
WHAT'S THE TOPIC ?
I PLAN TO FUSE SIX SIGMA WITH LEAN METHODS TO ELIMINATE THE GAP BETWEEN OUR STRATEGY AND OUR OBJECTIVES.
I'LL JUST SAY "WASTE OF TIME."


FOR A FAIR SELECTION EVERYBODY HAS TO TAKE THE SAME EXAM! PLEASE CLIMB THAT TREE
Our Education System
"Everybody is a genius. But if you judge a fish by its ability to climb a tree, it will live its whole life believing that it is stupid."
- Albert Einstein

Cartoons

On

Zero Defects

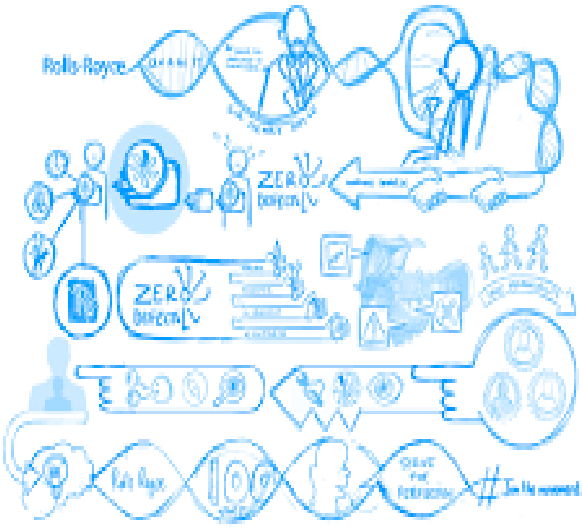
For goodness sake, I don't need to do a new risk assessment each time I cut a new tree...

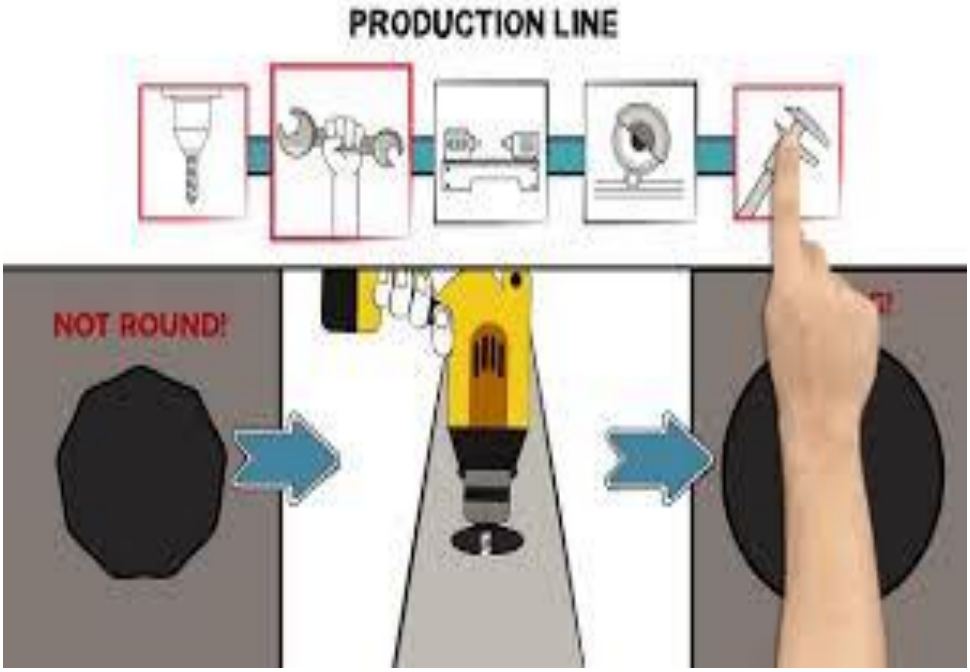
"That's not a manufacturing defect — It's *supposed* to have a hole in the middle."

Image Source- 3.bp.blogspot.com

"Zero is not only how much the premiums are, but also what the plan covers."

"GOOD NEWS IS, THE NUMBER OF COMPLAINTS WENT DOWN TO ZERO. BAD NEWS IS, THE NUMBER OF SALES WENT DOWN TO ZERO, TOO."





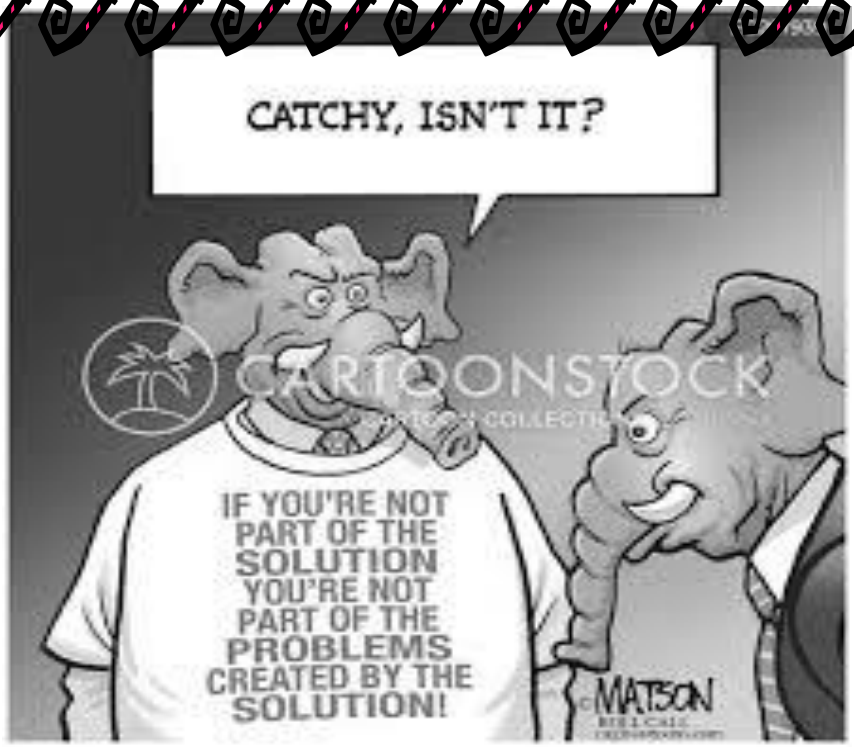
"Well, at least we eliminated all the problems we didn't have."

"No dependents, no deductions, no credits.... It doesn't *get* any better than this!"

Zero Defects

ZERO
TOLERANCE
AREA

WORKING
TOGETHER
TO PREVENT
& ELIMINATE
ZERO
DEFECTS


CATCHY, ISN'T IT?
IF YOU'RE NOT PART OF THE SOLUTION YOU'RE NOT PART OF THE PROBLEMS CREATED BY THE SOLUTION!
MATSON

2023 "Zero-Defects City"
Best Lead Actor Award

Zero Defect supplies
and
less Customer complaints
Smart Connect

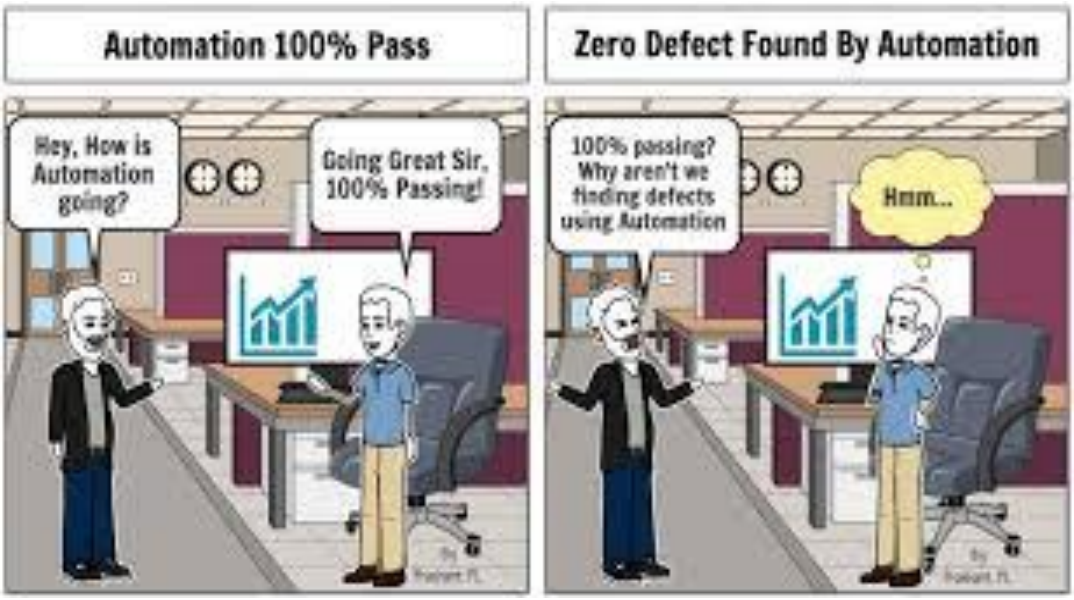
TOLERANCE
ZERO TOLERANCE

TAKE RESPONSIBILITY

ACTUALLY, I'M GLAD YOU GUYS ARE HERE.
THANKS.
YEAH. SURE MAKES THINGS MORE INTERESTING.
101
ZERO TOLERANCE

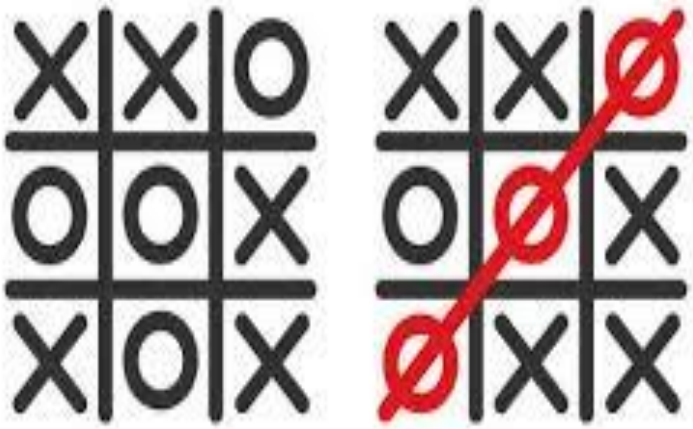
At the ball of string quality control department.

QUALITY FIRST
OUR AIM IS
ZERO
Defects
SP-2436299


Automation 100% Pass
Zero Defect Found By Automation
Hey, How is Automation going?
Going Great Sir, 100% Passing!
100% passing? Why aren't we finding defects using Automation
Hmm...

Zero Defects

Zero Defect supplies
and
less Customer complaints
Smart Connect



STILL SEPARATED
MISSING:
PARENTS of
545 CHILDREN
MISSING:
360 CHILDREN
MISSING:
ALL
COMPASSION

"We finally achieved zero fillings —
no teeth!"

"We've updated our healthcare plan. If you get sick, we'll send you a Get Well card. If the card doesn't make you feel better, you can sue the card company to pay for your hospital bills."

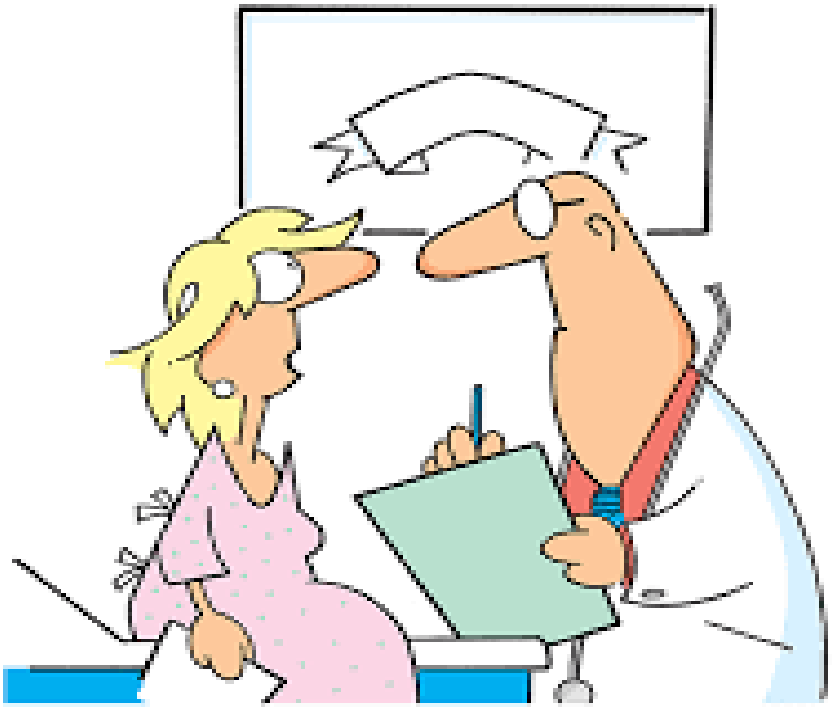
Waste Aware Animals
Furoshiki
Could you do this again, but a little bit slower, please...
Reusable alternative of wrapping paper:
Furoshiki (風呂敷) are a type of traditional Japanese wrapping cloth used to transport clothes, gifts, or other goods.
Source: www.wikipedia.org

HISTORY OF ENGLAND
MAGNA CARTA
SHAKESPEARE
NEWTON
THE GLORIOUS REVOLUTION
CAMPAIGN AGAINST THE SLAVE TRADE
GREAT REFORM ACT
VE-DAY
NATIONAL SELF-LOATHING

"Many women fear the word 'menopause', so I prefer to call it Puberty, Part II."

"It's guaranteed for the life of the product which,

"The Consumer Product Safety Commission today announced the recall of all E-Z Reclino-Mat chairs sold between ..."



"Which celebrities should I follow to get the best medical advice?"

"THE STATE 'LEMON LAW' DOES NOT APPLY TO ME."

"There's no free legal advice. That's just our way of weeding out the time wasters."

"You will die by a single bullet to the heart...
just one final question – any history of dextrocardia?"

"I told you that stupid GPS was defective. Should've returned it when we still had the chance."

Cartoons

On

SIX Sigma

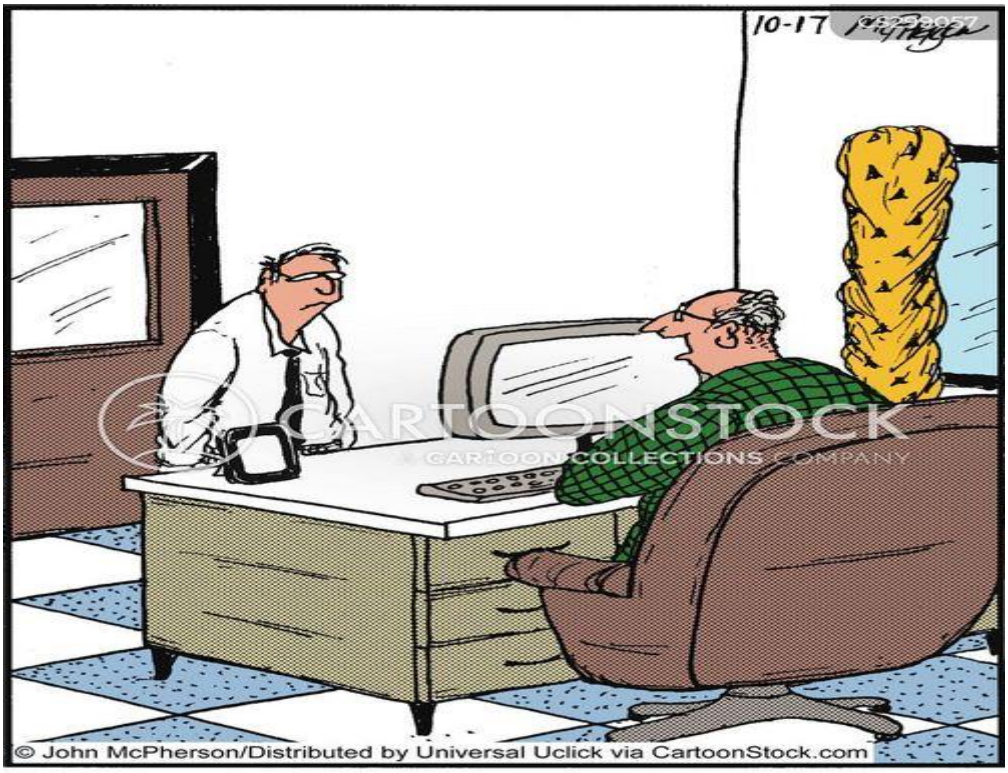
"As you can see, we've bundled your severance package."

CX918734
CAN I JUST FLAG MY CONCERNS VIZ THE CFO'S DISEMPOWERMENT SITUATION RE THE PROJECTED COUNTER-DOWNSIZING MONIES...
YOU'RE ALL REDUNDANT
SIMULTANEOUS TRANSLATION

"I'm bringing in an outside firm to help streamline the way we make things more complicated than need be."

"Burns, you've done a good job downsizing, but we've decided to outsource your function."

"Don't think of it as getting fired. Think of it as finally being recognized for your incompetence."



"Your severance package is that we got you an audition on 'Wheel of Fortune.'"

"Help me on this one, Jimbo. What I want to do here is fire you."

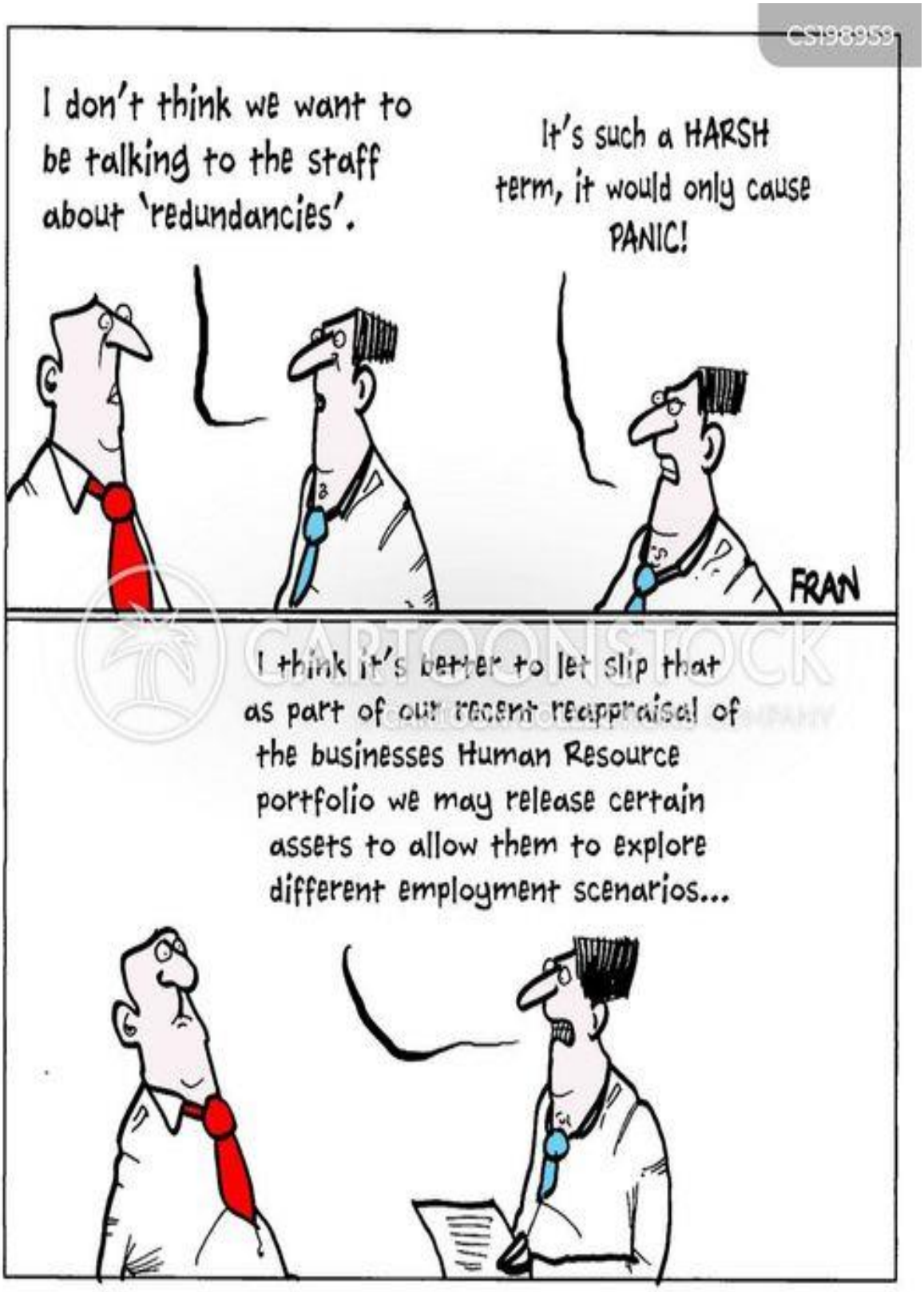
"We're developing a plan to fix this."

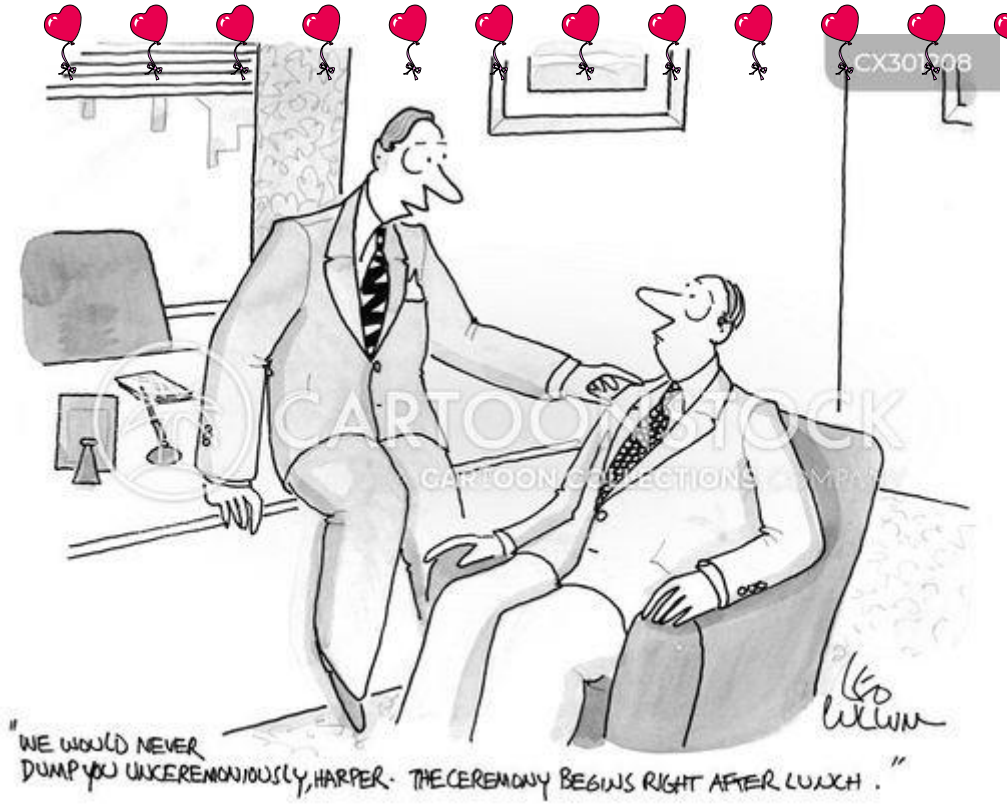
"YOU'VE COST THIS COMPANY MILLIONS, SO WE HAVE NO CHOICE BUT TO GET RID OF YOU WITH A MILLION DOLLAR SEVERANCE PACKAGE"

SO, HOW WAS YOUR "FIVE WHYS" ANALYSIS MEETING?
WE ONLY GOT UP TO THREE "WHYS" AND A "WHAT THE HELL".
J.Sho.

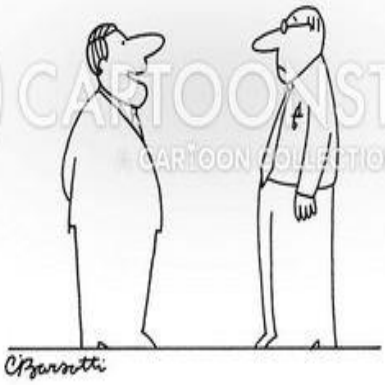
AGILE
Or should it be SRUM or KANBAN ???
LEAN
SIX SIGMA

"At least you didn't get the axe."


CS198959
I don't think we want to be talking to the staff about 'redundancies'.
It's such a HARSH term, it would only cause PANIC!
FRAN
I think it's better to let slip that as part of our recent reappraisal of the businesses Human Resource portfolio we may release certain assets to allow them to explore different employment scenarios...


CX301308
"WE WOULD NEVER DUMP YOU UNCEREMONIOUSLY, HARPER. THE CEREMONY BEGINS RIGHT AFTER LUNCH."

CX301285
"I'VE ASKED YOU TO THIS MEETING, PAULSON, TO PUT A HUMAN FACE ON RIGHTSIZING."



"DON'T TAKE IT PERSONALLY, WE'RE LAYING OFF THOUSANDS."

"Marissa, have we a lovely parting gift for Mr. Griswold?"

And exactly how much less did it cost to implement Five Sigma instead of Six, Dwayne?

"LEAN, WHAT LEAN?"

"Oh, that *is* the businessman's lunch, sir — 'lean and mean.'"

"It's a big responsibility but I believe I can be both 'Joe six pack' and 'Joe six gun'."

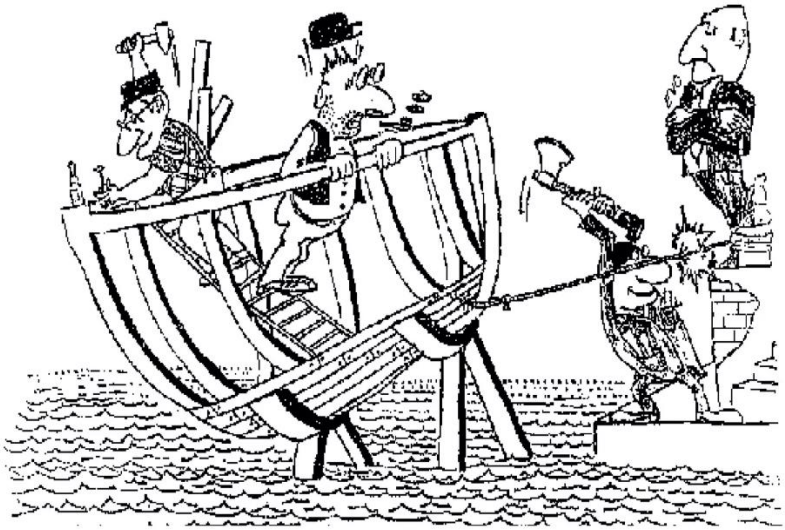
1

Nothing can stop automation

Stefan Pölt, FRA IN/P

2

Don't set too ambitious deadlines



Deadline is deadline !

Stefan Pölt, FRA IN/P

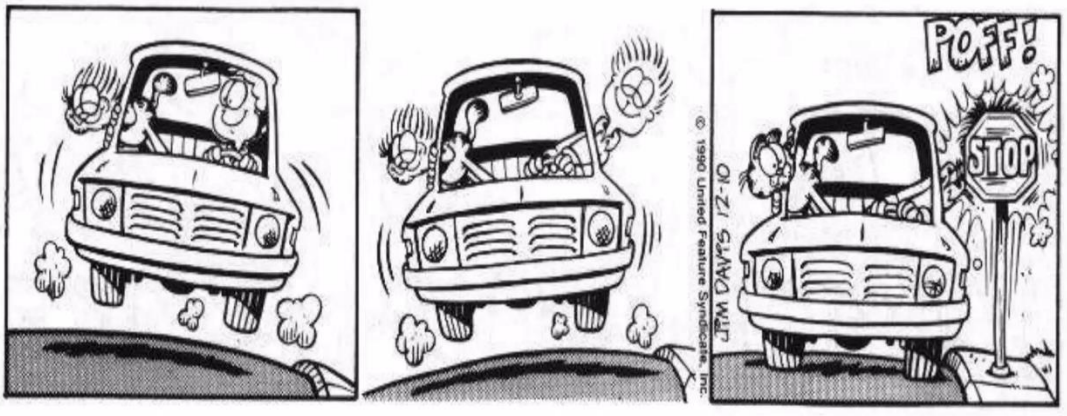
4

Users don't like bugs

Stefan Pölt, FRA IN/P

7

What suits one customer might not suit the next



Stefan Pölt, FRA IN/P

10

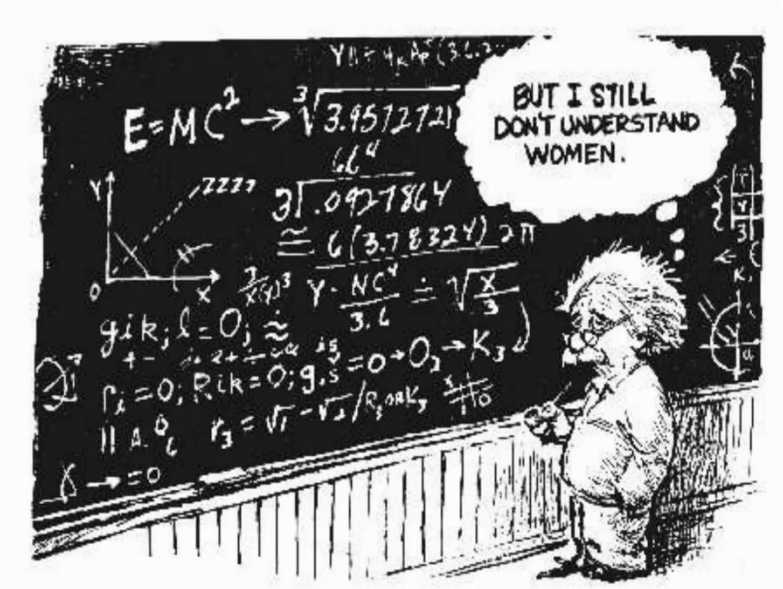
On-line help can be useful

"Nurse, get on the internet, go to SURGERY.COM, scroll down and click on the 'Are you totally lost?' icon."

Stefan Pölt, FRA IN/P

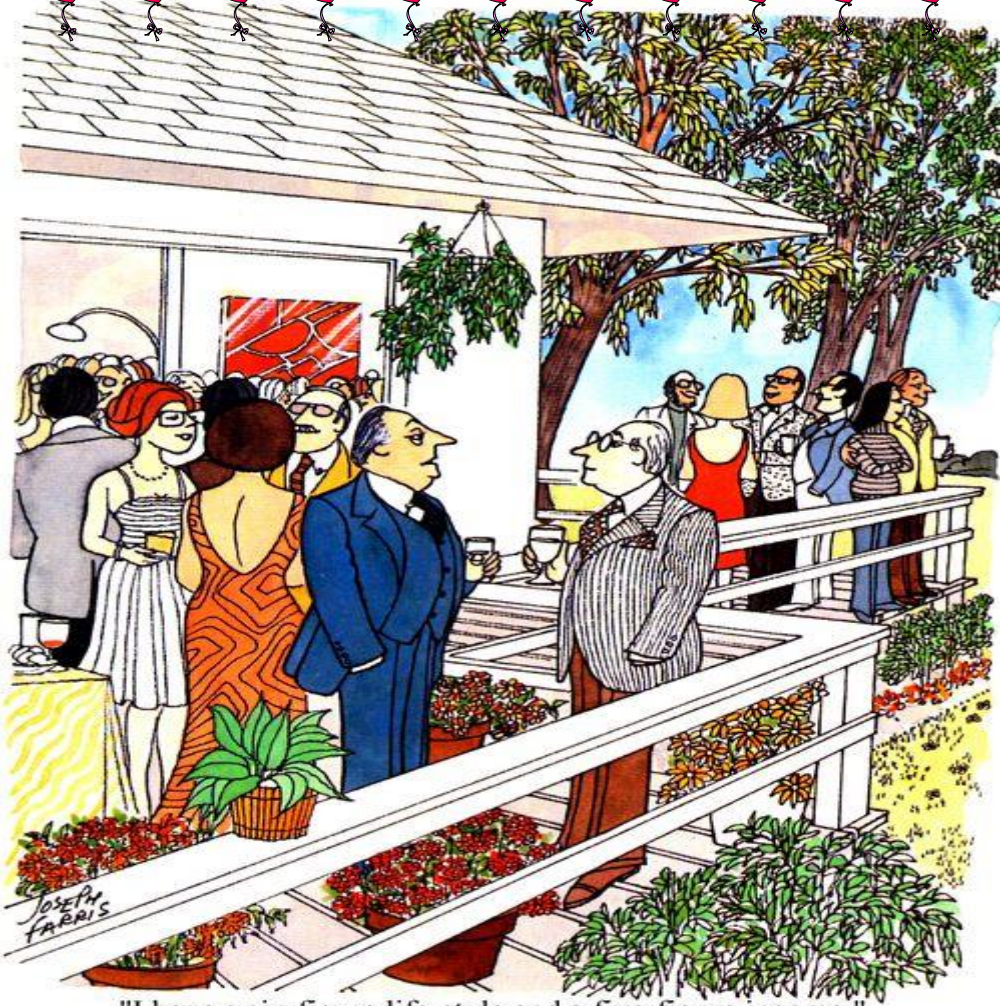
13

Maths is not everything



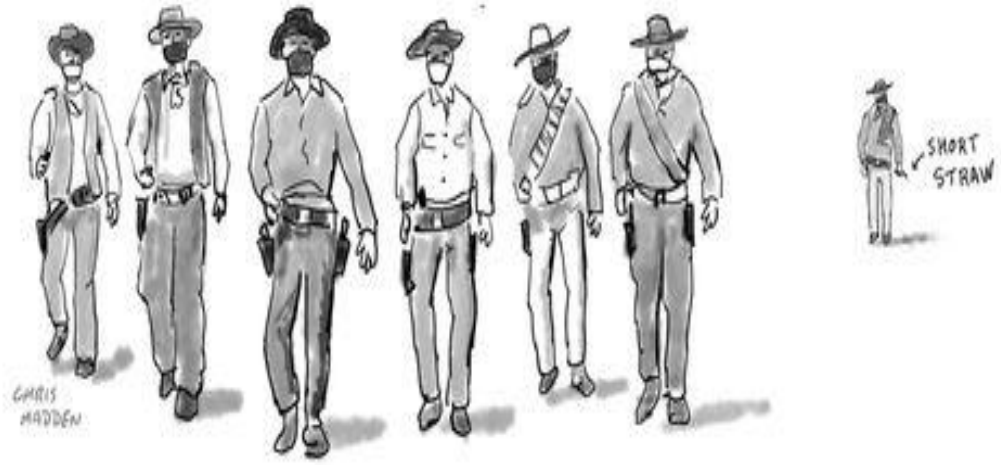
Stefan Pölt, FRA IN/P

" Now are you convinced this company is going to be lean and mean ? "



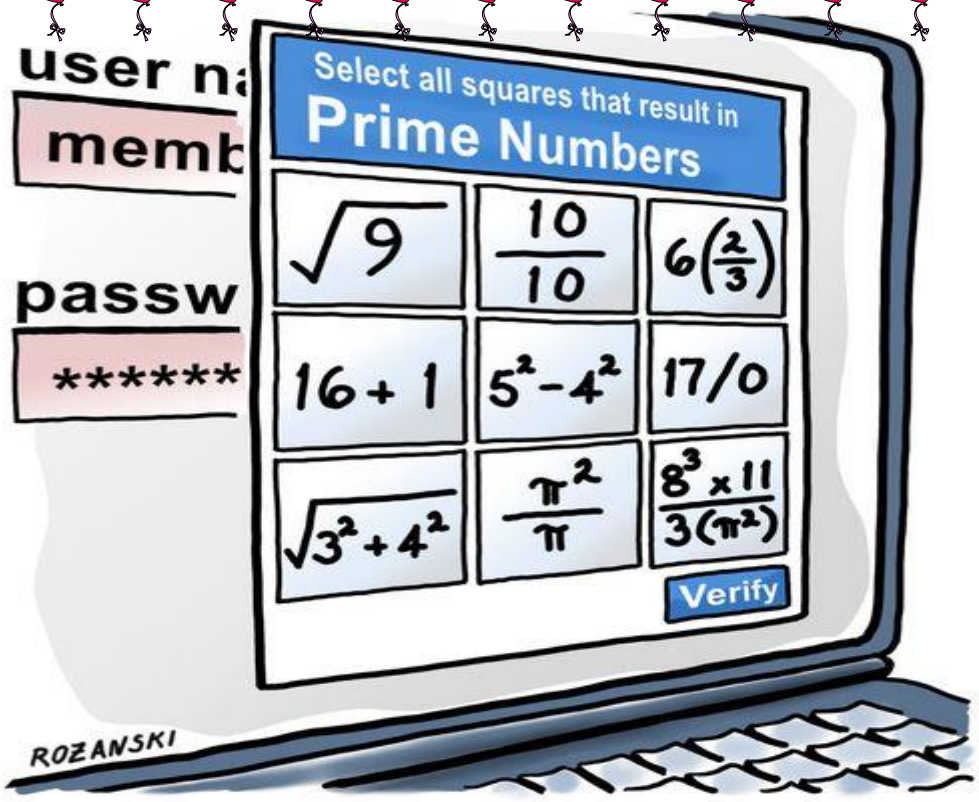
"I have a six-figure life-style and a five-figure income."

THE MAGNIFICENT SEVEN ADHERE TO THE COVID RULE OF SIX

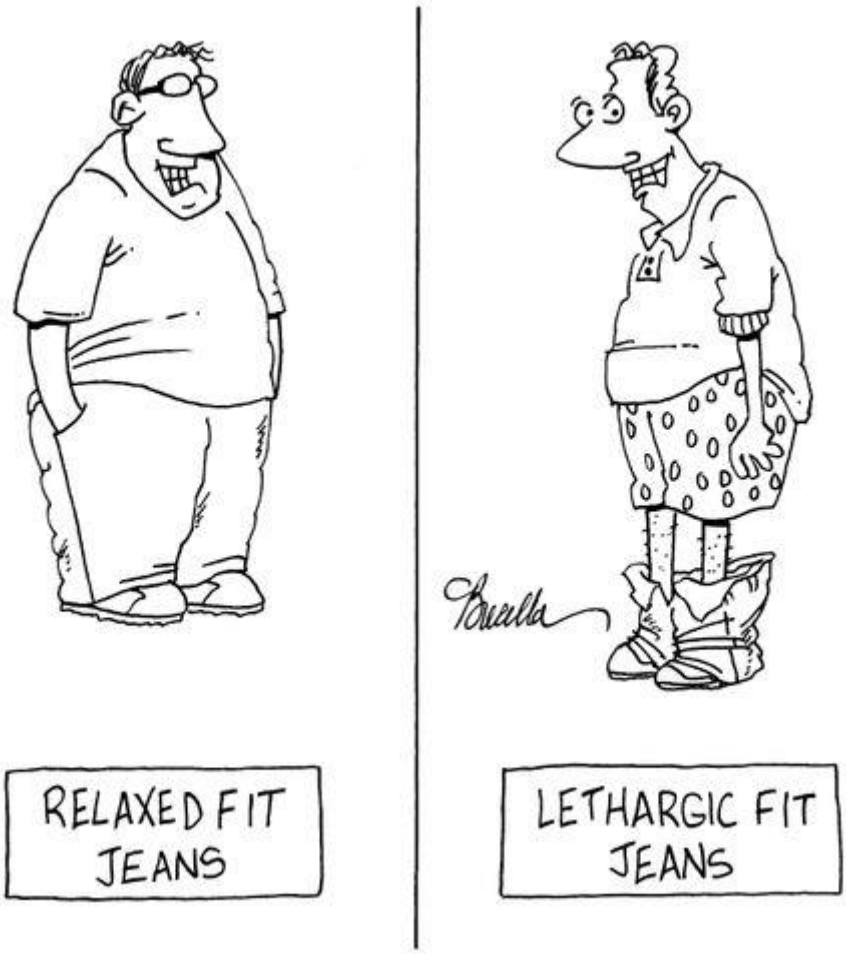


LEAN IN! DEMAND A RAISE! AND BE SURE TO "LIKE" THE ADS ON FACEBOOK, SO OUR SHAREHOLDERS WILL THINK WE'RE ACTUALLY PROFITABLE!
©Taylor Jones - All rights reserved.
caglecartoons.com

"It turns out your tax shelter is more of a tax lean-to."



MENSA Login Security



"If you're not making six figures in five years,
I wouldn't be at all surprised."

It's a new role, very much in line with the firms new zeitgeist aiming at a new target rich, challenging resource lean environment.
He wants me to work twice as hard for half as much with no support.
FRAN

"CHARLES HAS A SIXTH SENSE - HE CAN SMELL MONEY."

"It's a big responsibility but I believe I can be both 'Joe six pack' and 'Joe six gun'."

CARTOON CLASSICS

on

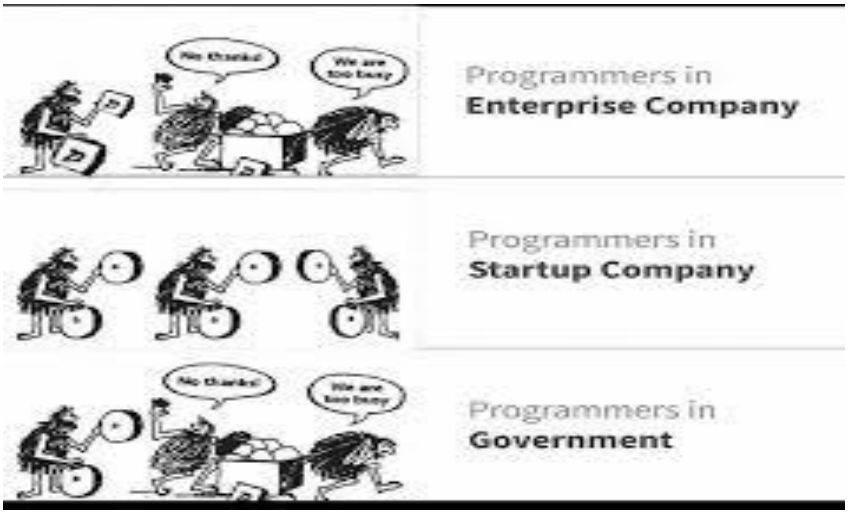
14 Points

"I don't have time to see any crazy salesman; I have a battle to fight."

ARE YOU TOO BUSY TO INNOVATE?

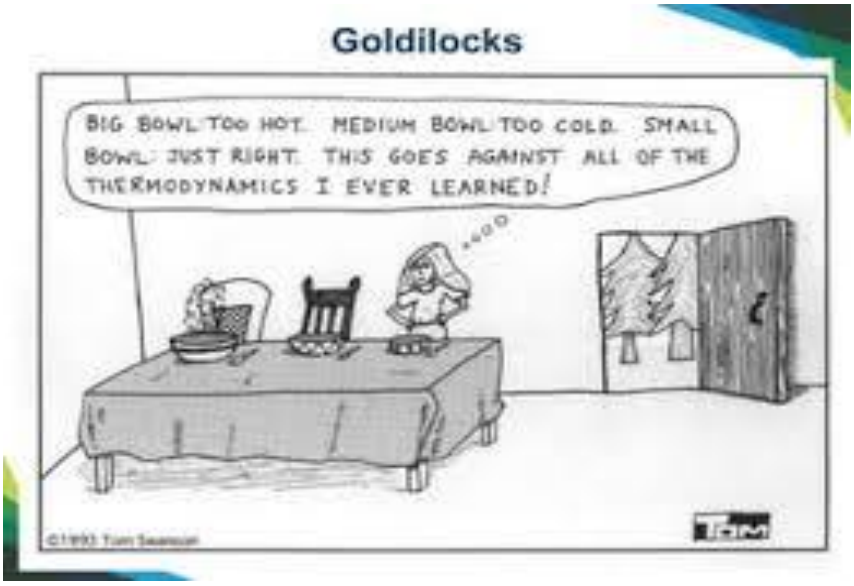
"No! I can't be bothered to see any crazy salesmen... we've got a battle to fight!"

Take Some New Tools for a Spin
Some of the best inventions start with something great and make it even better.
AI MAXTools
for PTC Creo Elements/Direct (CoCreate)
Modeling versions 15-20+

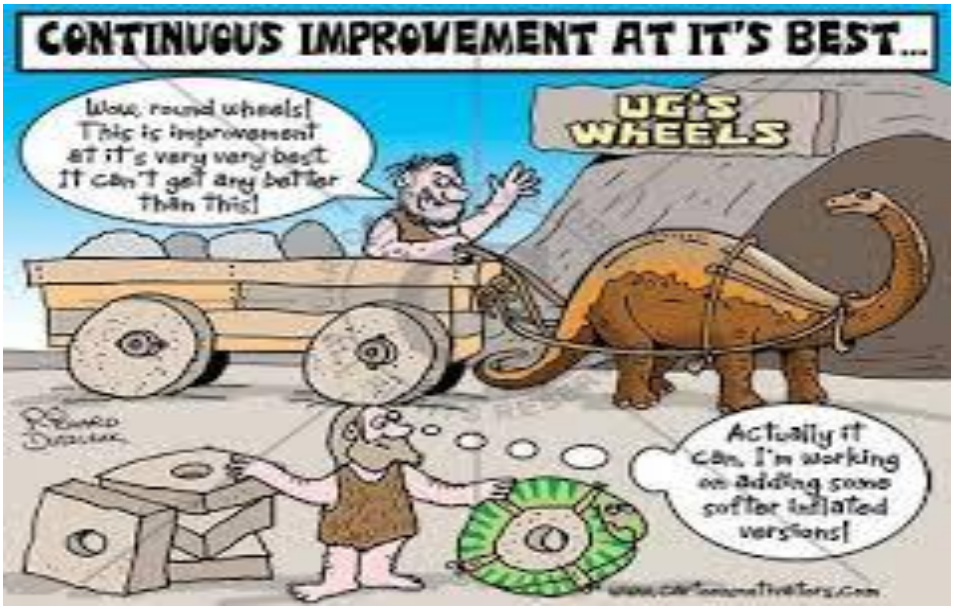

Programmers in
Enterprise Company
Programmers in
Startup Company
Programmers in
Government

"Can't you see we're too busy?"

ARE YOU TOO BUSY TO INNOVATE?

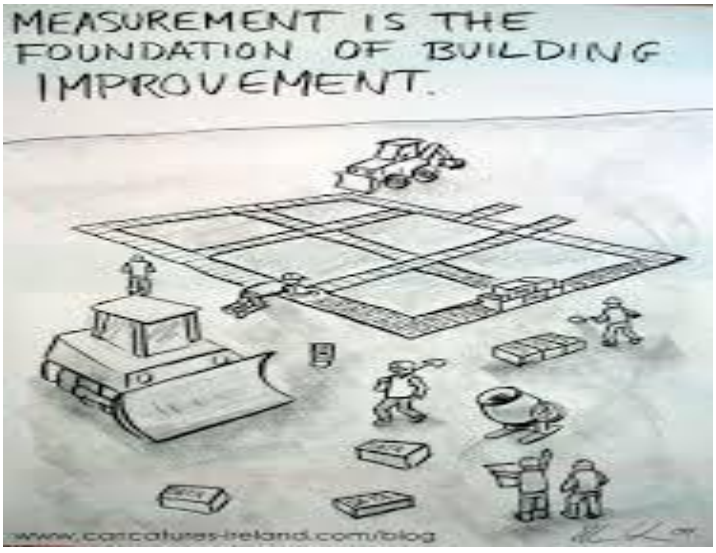

Goldilocks
BIG BOWL TOO HOT. MEDIUM BOWL TOO COLD. SMALL BOWL JUST RIGHT. THIS GOES AGAINST ALL OF THE THERMODYNAMICS I EVER LEARNED!

GROK THE INVENTOR

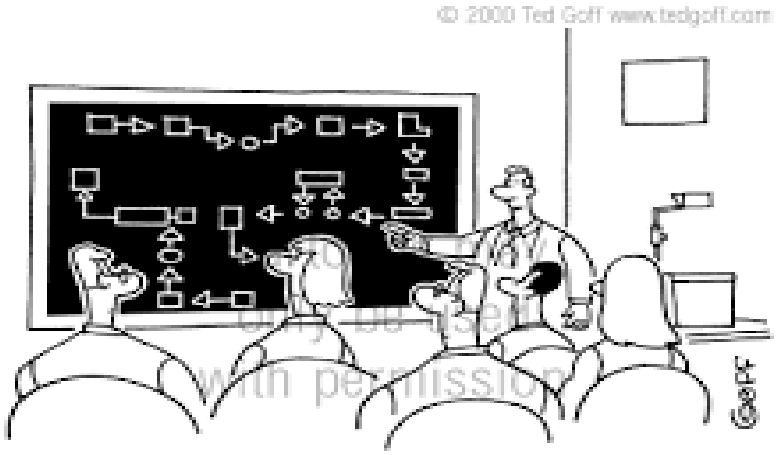

CONTINUOUS IMPROVEMENT AT IT'S BEST...
Wow, round wheels! This is improvement at it's very very best. It can't get any better than this!
UG'S WHEELS
Actually it can. I'm working on adding some softer inflated versions!

AHOY THERE!
SORRY, I'M TOO BUSY!
resourcefulmanager.com

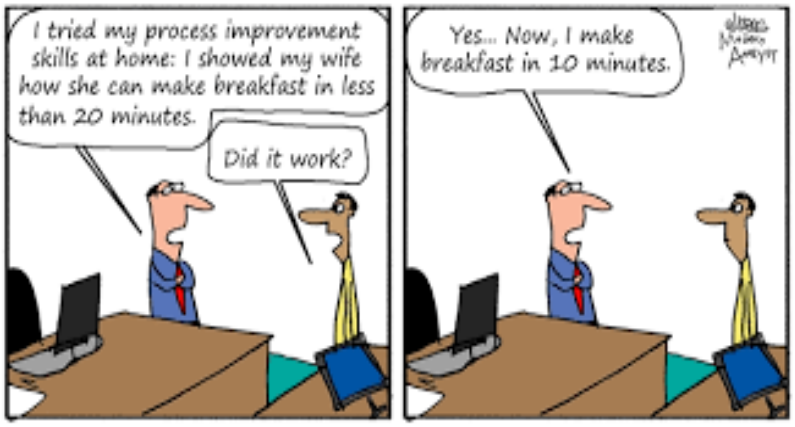
"Great... Just what we need: another quality-improvement campaign!"



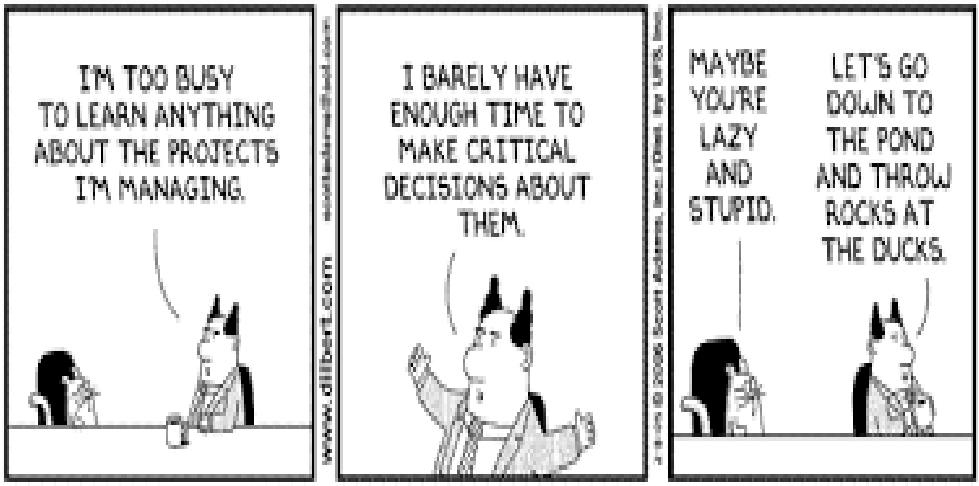
"If I stop to smell the roses, then all the other flowers will expect me to smell them too and I'm just too busy for that!"



"If we process the work this way, everyone will get more exercise."


I tried my process improvement skills at home: I showed my wife how she can make breakfast in less than 20 minutes.
Did it work?
Yes... Now, I make breakfast in 10 minutes.

"EATING THE MISTAKES IS A TOUGH JOB, BUT SOMEBODY HAS TO DO IT."


I'M TOO BUSY TO LEARN ANYTHING ABOUT THE PROJECTS I'M MANAGING.
I BARELY HAVE ENOUGH TIME TO MAKE CRITICAL DECISIONS ABOUT THEM.
MAYBE YOU'RE LAZY AND STUPID.
LET'S GO DOWN TO THE POND AND THROW ROCKS AT THE DUCKS.
www.dilbert.com
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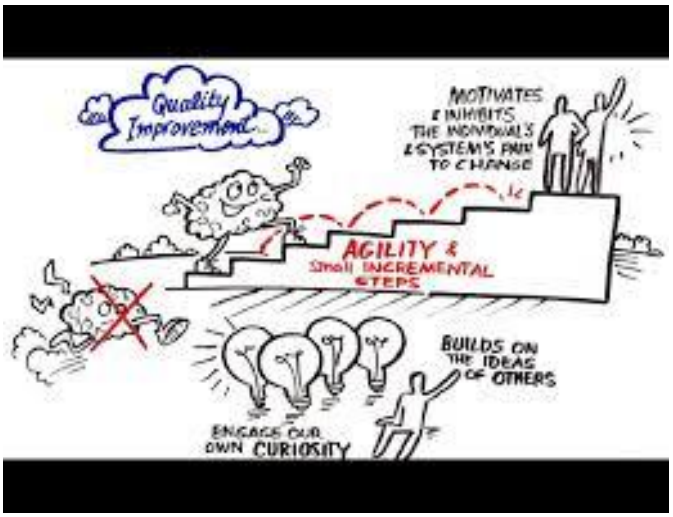
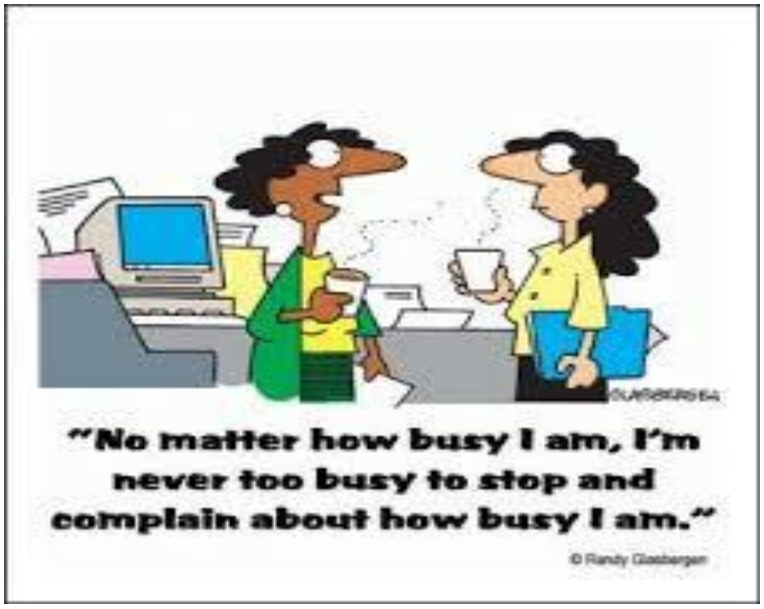

Quality Improvement
MOTIVATES & INHIBITS THE INDIVIDUAL'S & SYSTEM'S PAIN TO CHANGE
AGILITY & Small INCREMENTAL STEPS
BUILDS ON THE IDEAS OF OTHERS
ENGAGE OUR OWN CURIOSITY


"No matter how busy I am, I'm never too busy to stop and complain about how busy I am."
© Randy Glasbergen

Are you too busy to innovate?
We are too busy

Continuous Improvement Software
Too Busy to Improve?
I HAVE A GREAT PROPOSAL, WANT TO HEAR IT?
NO THANKS, WE ALREADY HAVE A SYSTEM IN PLACE.
CAN'T STOP, TOO BUSY
WE DON'T HAVE THE TIME, GOT KPI'S TO HIT.
CIS
COMPLETE
SYSTEM ERROR
QUALITY DEPT.

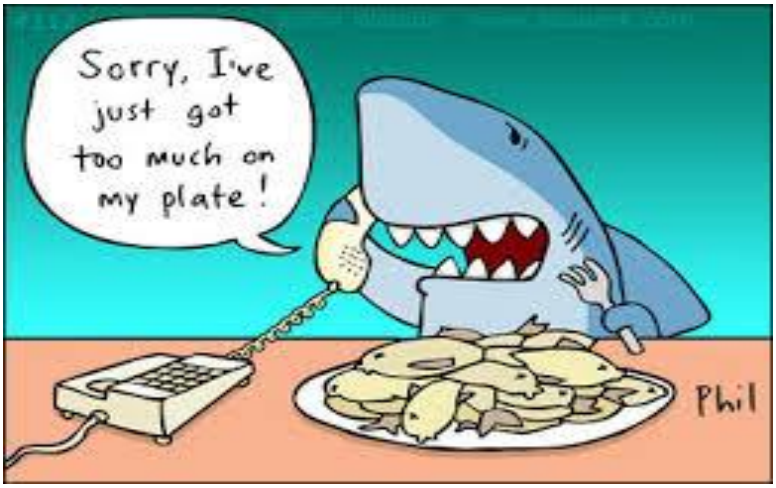
#7 INTUITIVE LEADERSHIP

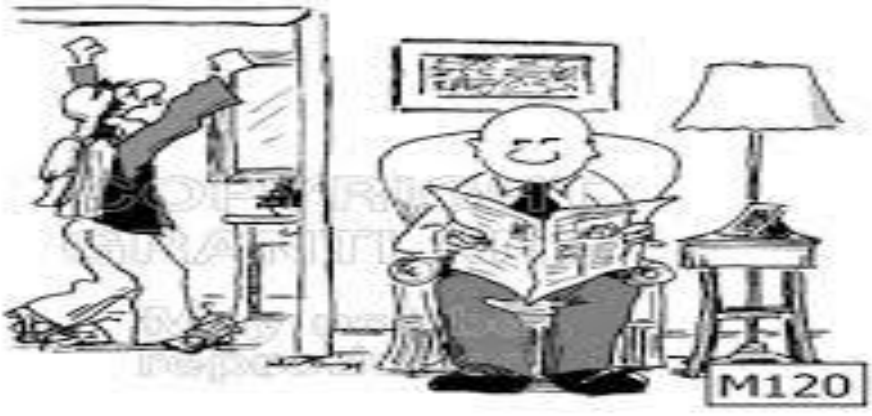
- The leaders select the music, set the tone and insure that everyone is on board at every moment.

"OK, so, last week you were wondering what a stripped-down version of management might look like."

Copyright 2002 by Randy Glasbergen.
www.glasbergen.com

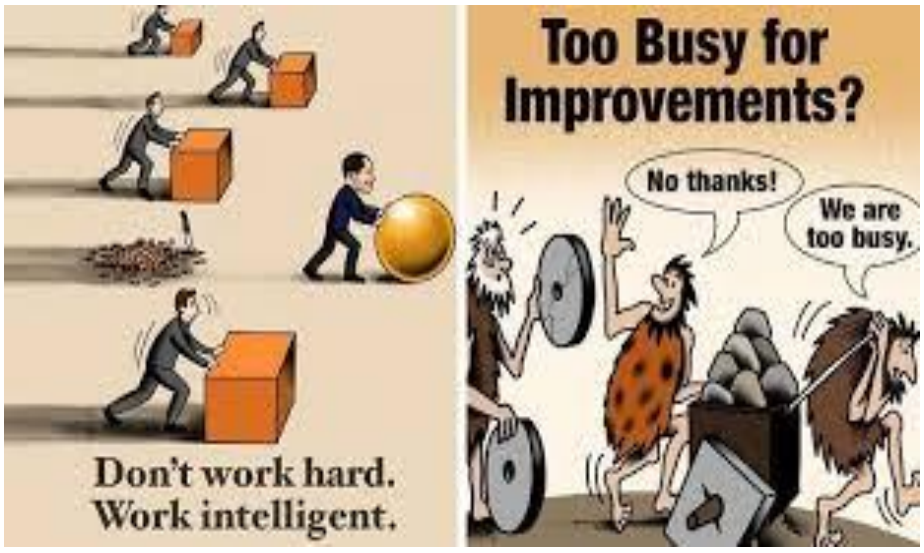
"I have a delivery for you: 1000 pens with the slogan 'Excellence is in the Detales' and 500 factory-second, slightly irregular coffee mugs that say 'Quality Matters'."





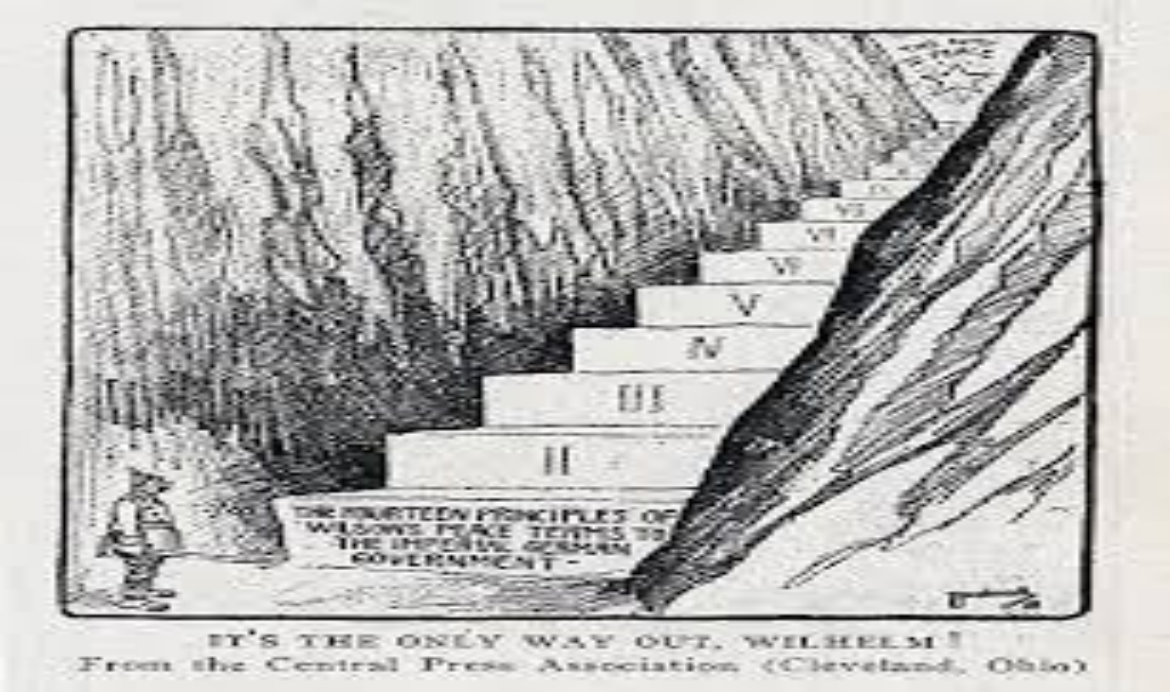
"Do it right! Do it right! That's all I ever hear! I can't wait to get out of school and go into business!"

I can't see my screen!!!


Don't work hard.
Work intelligent.
Too Busy for Improvements?
No thanks!
We are too busy.

IN CLOSING: CHANGE IS GOOD! CHANGE IS INEVITABLE! CHANGE IS EXCITING!
QUESTIONS?
WHO'S GETTING LAID OFF?

It is outrageous that the Legislature funded a $48 million Taj Mahal state courthouse in these hard times!
Oh, he's from Jacksonville where they're spending $50 million for their Taj Mahal courthouse!
What's with him?


THE FOURTEEN PRINCIPLES OF WILSONS PEACE TERMS TO THE IMPERIAL GERMAN GOVERNMENT -
IT'S THE ONLY WAY OUT, WILHELM!
From the Central Press Association (Cleveland, Ohio)

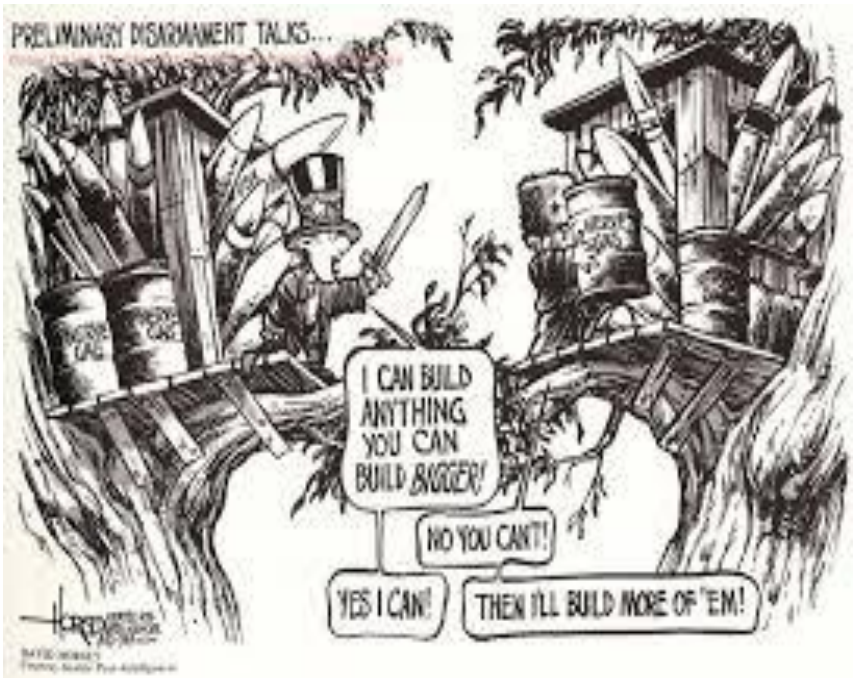
LEND-LEASE ACT
and the Political cartoons of Dr. Seuss
U.S. LEND LEASE
DUNK

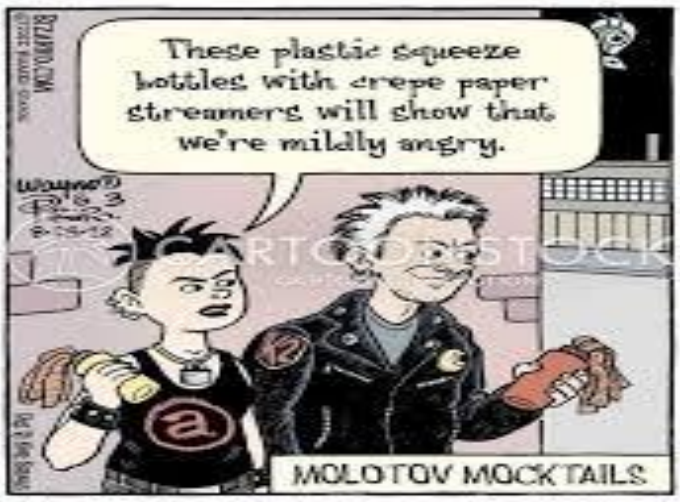
EUROPEAN BABY SHOW

"Poor things,' they can't take care of themselves."

VOTES FOR WOMEN

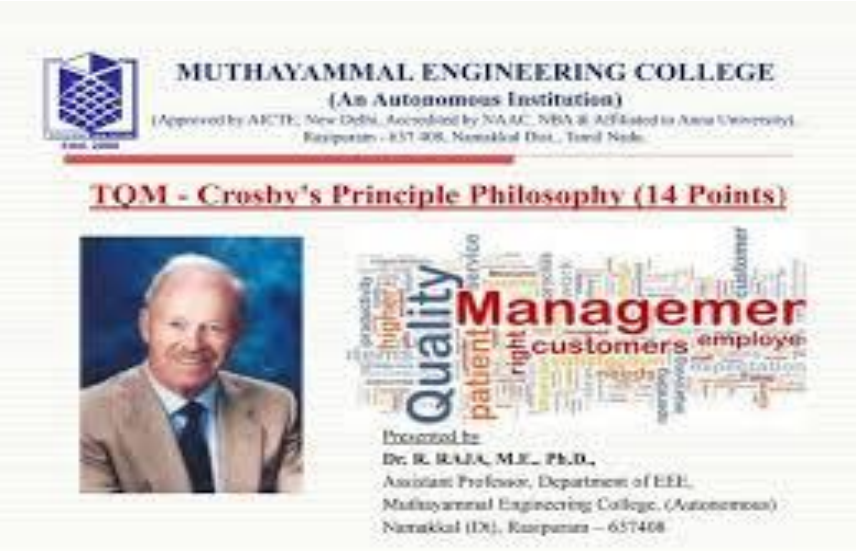
CAMBIE ESO A: "GENTE BLANCA, HETEROSEXUAL, NO-INMIGRANTE, CRISTIANA."

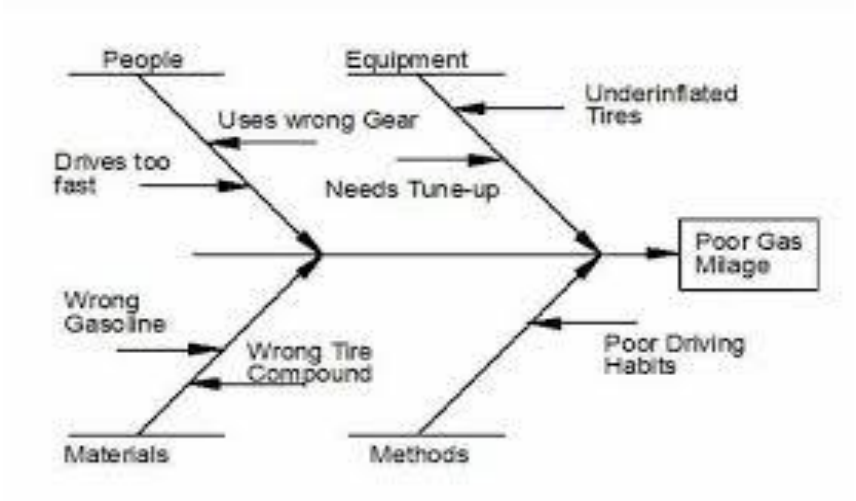

PRELIMINARY DISARMAMENT TALKS...
I CAN BUILD ANYTHING YOU CAN BUILD BIGGER!
NO YOU CAN'T!
YES I CAN!
THEN I'LL BUILD MORE OF 'EM!

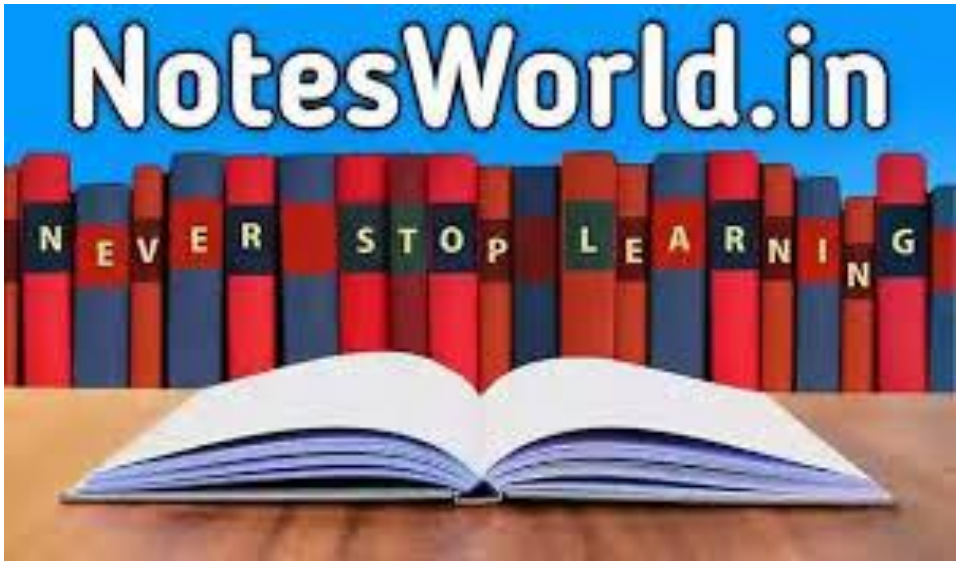

These plastic squeeze bottles with crepe paper streamers will show that we're mildly angry.
MOLOTOV MOCKTAILS

WE HANGIN' OUT TODAY, ROSE?
I HAVE CAMP, AMELIA
MATH CAMP, SPECIFICALLY
YOU KNOW WHAT'S GREAT ABOUT MATH? THE ANSWERS ARE EITHER RIGHT OR THEY'RE WRONG
AND I DON'T ENJOY BEING WRONG
HOW 'BOUT BEING BAD?

QUALITY CIRCLE DEFINITION
Quality Circle


MUTHAYAMMAL ENGINEERING COLLEGE
(An Autonomous Institution)
TQM - Crosby's Principle Philosophy (14 Points)
Quality
Managemer
customers
employe
patient
right
Presented by
Dr. R. RAJA, M.E., Ph.D.,
Assistant Professor, Department of EEE,
Muthayammal Engineering College, (Autonomous)
Namakkal (Dt), Rasipuram – 637408


People
Equipment
Uses wrong Gear
Underinflated Tires
Drives too fast
Needs Tune-up
Poor Gas Milage
Wrong Gasoline
Wrong Tire Compound
Poor Driving Habits
Materials
Methods


NotesWorld.in
NEVER STOP LEARNING

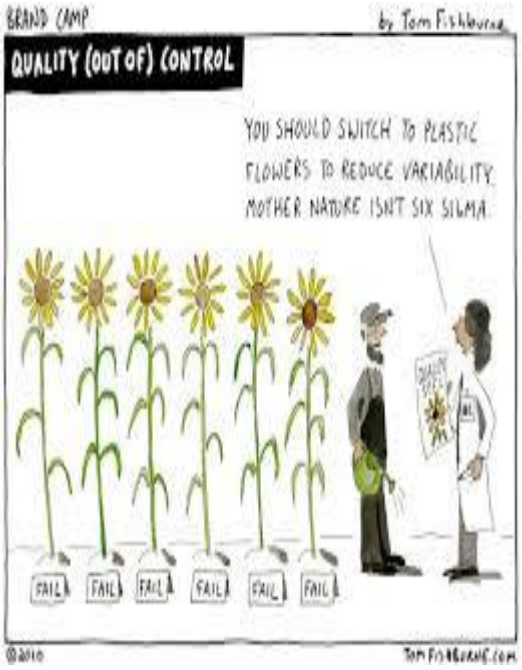
Cartoons
on
Quality is Free

"Your evaluation is based on the next 30 seconds. Go!"

Quality Control Inspectors at the Funhouse Mirror Company

"Do it right! Do it right! That's all I ever hear! I can't wait to get out of school and go into business!"

"Mr. Colton, do we stand behind our products?"



To be honest, the hardest part was the ISO certification.

"EATING THE MISTAKES IS A TOUGH JOB, BUT SOMEBODY HAS TO DO IT."

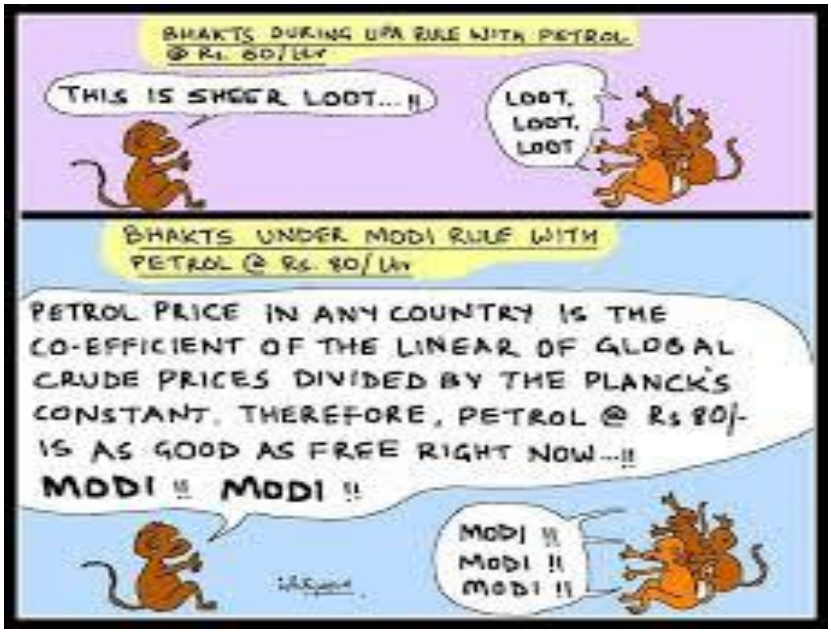
© 1995 Ted Goff www.tedgoff.com

"They say that I'm a customer and that they're working to make everybody's job a lot better....
DEPARTMENTAL MISSION STATEMEN
M137
"I say they're not working hard enough."

"The Quality Control Recommendations? I filed them under 'T' for 'To Be Read Someday.'"

"Do you ever feel like you're cheating on your old shoes?"

LOOK YOU NERDS
IT'S A SIMPLE BUSINESS MODEL
YOU HAND ME THE FRUIT OF YOUR WORK FOR FREE
YOU REVIEW ITS QUALITY FOR FREE
AND THEN YOU PAY ME TO ACCESS IT
CAPISCE?


BHAKTS DURING UPA RULE WITH PETROL @ Rs. 80/Ltr
THIS IS SHEER LOOT...!!
LOOT, LOOT, LOOT
BHAKTS UNDER MODI RULE WITH PETROL @ Rs. 80/Ltr
PETROL PRICE IN ANY COUNTRY IS THE CO-EFFICIENT OF THE LINEAR OF GLOBAL CRUDE PRICES DIVIDED BY THE PLANCK'S CONSTANT. THEREFORE, PETROL @ Rs 80/- IS AS GOOD AS FREE RIGHT NOW...!!
MODI !! MODI !!
MODI !! MODI !! MODI !!

"WELL, THEY WERE THE LOW BIDDERS."

"If he doesn't like you you'll know right away."

WHATAYA MEAN YOU CAN'T FIX THE PROBLEM? WHAT HAPPENED TO THE QUALITY YOU ASSURED ME OF BY MONITORING AND RECORDING THIS CALL?

To help deal with overcrowding, many schools have begun to shrink-wrap their students.

"And by 'recorded for quality assurance', we mean recorded to cover our backsides."

"I can take his 1000 watt smile, but his 5000 lumen LED outdoor bright idea lightbulb is too much!"

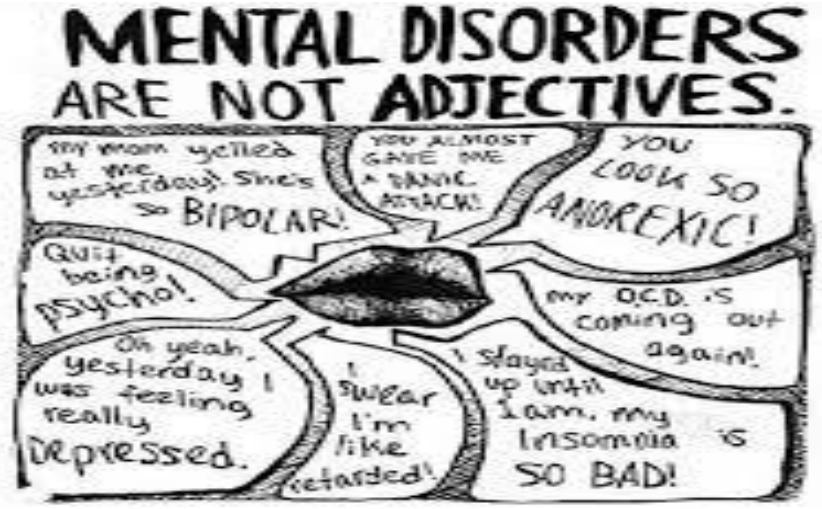
"I'm writing you a prescription. Do you want a longer life with less quality or vice versa?"

"Considering my cash flow, best practices would prescribe that you pick up the check."

"You seem to have ALL the qualities we're looking for, Mr. Burke. You're not real, but we'll just have to work around that."

QUALITY CONTROL

QUALITY CONTROL
RED..AMBER..GREEN, RED..AMBER..GREEN, RED..

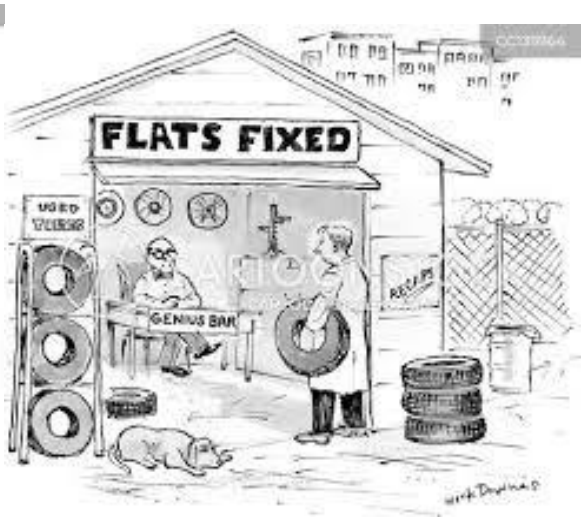

MENTAL DISORDERS ARE NOT ADJECTIVES.
my mom yelled at me yesterday. She's so BIPOLAR!
YOU ALMOST GAVE ME A PANIC ATTACK!
YOU LOOK SO ANOREXIC!
Quit being psycho!
my O.C.D. is coming out again!
Oh yeah, yesterday I was feeling really DEPRESSED.
I swear I'm like retarded!
I stayed up until 1am. my insomnia is SO BAD!

"Transfer Brainard to the mail room. He suggested we save costs by outsourcing our quality assurance activities to our customers."

"Please continue to hold. This call may be monitored for quality purposes. Of course, if we really cared about quality, we'd hire more people to answer the phones."

QUALITY CONTROL
QUALITY CONTROL
"I ALSO THOUGHT IT WOULD BE IMPOSSIBLE FOR AN OBSESSIVE-COMPULSIVE TO GET A RESPONSIBLE JOB."

I'm here about the inspecting....


FLATS FIXED
GENIUS BAR

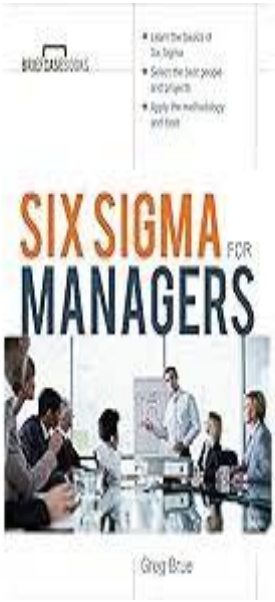
A LITTLE MORE EXPOSURE, LADIES.. PLEASE-

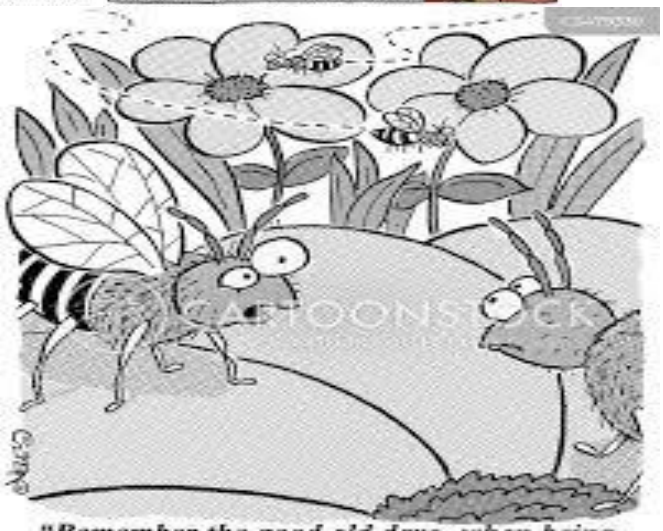
It says it's the vodka that's distilled twenty-nine times—they just can't seem to get it right.

I'M SO SICK OF 'POLITICAL CORRECTNESS.'
OKAY, TRY IT WITHOUT THE 'POLITICAL CORRECTNESS' THEN.
I'M SO SICK OF NOT BEING ABLE TO INSULT AND BELITTLE WOMEN AND MINORITIES.

"FOR QUALITY CONTROL PURPOSES, THIS PHONE CALL MAY BE RECORDED AND REPLAYED FOR LAUGHS AT VARIOUS OFFICE PARTIES THROUGHOUT OUR COMPANY"

"I'M IMPRESSED BY YOUR ANALYSIS OF THE PROJECT'S FAILURE, BOB...EXCEPT THE PART THAT IT'S MY FAULT!"





"Remember the good old days, when being busy was enough? All this new emphasis on productivity, quality control and measurable outcomes is making my head spin!"

"OFFICE MORALE IS AT AN ALL TIME LOW! WE'LL NEED TO SKIP BREAKS AND WORK THROUGH OUR LUNCHES UNTIL SOMEONE COMES UP WITH A PLAN TO FIX THIS!"

"Great... Just what we need: another quality-improvement campaign!"

"When that automated message says, 'Your call may be recorded for quality assurance,' it's to keep the quality of our customer service low."

"Davis, I'm beginning to think that quality control isn't your niche."

"Don't inspect too hard.... I have a **production quota** to meet."

IN THE SHORT TIME YOU'VE WORKED IN QUALITY ASSURANCE, YOU'VE FOUND A HUGE NUMBER OF FLAWS IN OUR PROTOTYPE.
THAT'S MY JOB!
YOU'RE JEOPARDIZING OUR SCHEDULE. THE ENTIRE PROJECT WILL FAIL AND IT'S ALL YOUR FAULT.
WHY IS IT MY FAULT?
IF A TREE FALLS IN THE FOREST... AND WE'VE ALREADY SOLD THE TREE... DOES IT HAVE QUALITY?
HOW MANY ANGELS CAN DANCE ON YOUR HEAD?

I CUT THE QUALITY CONTROL BUDGET TO FREE UP FUNDS TO INCREASE OUR SALES FORCE.
SO YOUR STRATEGY IS TO SELL A LARGER VOLUME OF DEFECTIVE PRODUCTS?
THE QUALITY WILL BE FINE. THE TESTS WILL JUST TAKE LONGER.
SO... IT'S AN ANTIQUE THING?

LITIGATION
"Our only option is to improve quality or hire more lawyers."

PARTYVILLE
TRICK BIRTHDAY CANDLES
Quality Control Department
REJECTS

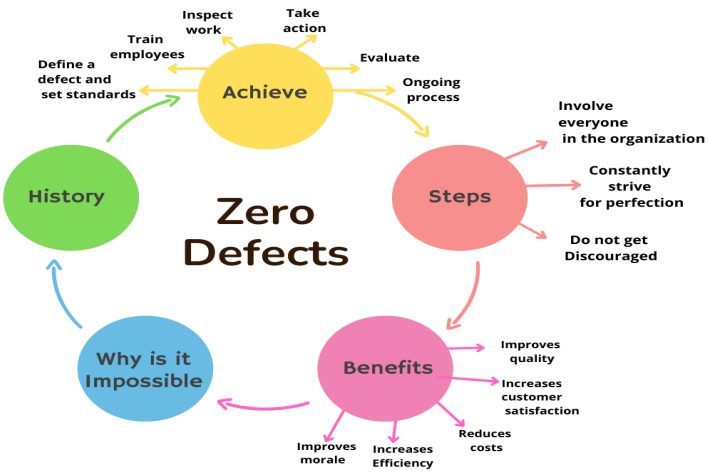
NO
WAY
WAY

Bowlerhat adventures
Project Management Training
What means QCD?
Q = Quality
C = Cost
D = Deadline respect
I though that is was
Q = Quick
C = Cheap
D = Dirty

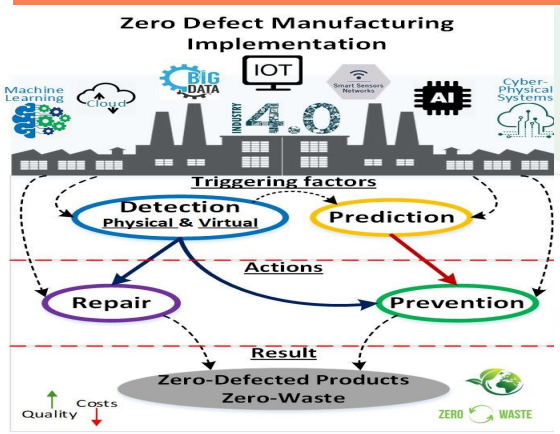
THEY CAN MAKE ME WORK IN A LITTLE BOX, BUT THEY CAN'T CRUSH MY SPIRIT.
OUR ISO 9000 COORDINATOR DIED OF BOREDOM. YOU'LL HAVE TO DO HIS JOB PLUS YOURS.
AND ONE OF THE QUALITY ASSURANCE GUYS IS LOOKING PALE...

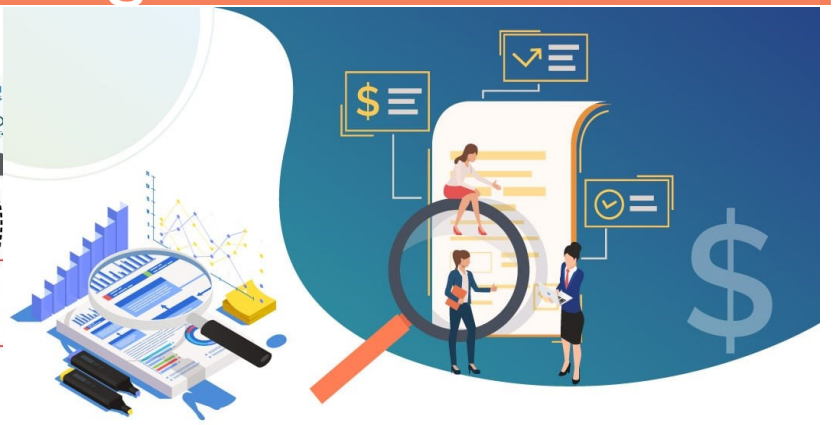
Quality Nightmares
by MasterControl
"Have you guys considered actually improving quality and making a better product?"

PLANNING
ISO
STANDARDIZE
QUALITY
QUALITY MANAGEMENT
OPTIMIZATION
SUCCESS
CONTROL
COSTS



What does Zero Defects Mean for Quality Management?





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Simple & Practical

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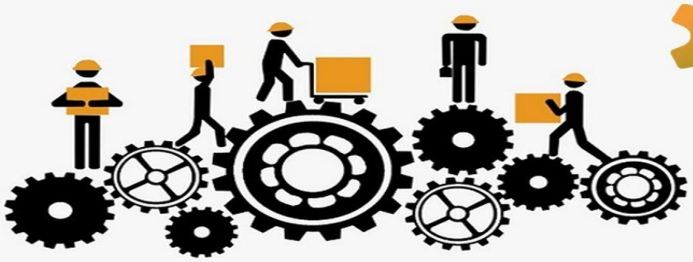
MICRO, SMALL & MEDIUM ENTERPRISES
सूक्ष्म, लघु एवं मध्यम उद्यम



ZED™
ZERO DEFECT · ZERO EFFECT

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- ✓ Focus Points
- ✓ Benefits
- ✓ Implementation Methodology

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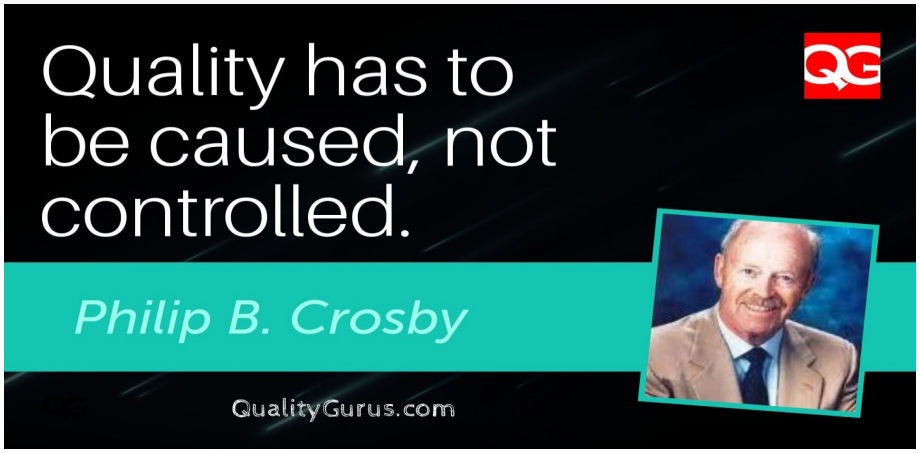
ISBN 978-81-972782-9-7
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